ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

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"Through the release of atomic energy, our generation has brought into the world the most revolutionary force since the prehistoric discovery of fire. This basic power of the universe cannot befitted into the outm ded concept of narrow nationalisms. For there is no secret and there is no defence; there is no possibility of control except through the aroused understanding and insistence of the peoples of the world.

We scientists recognize our inescapable responsibility to carry to our fellow citizens an understanding of the simple facts of atomic energy and its implications for society. In this lies our only security and our only hope. We believe that an informed citizenry will act for life and not death."

Albert Einstein

"You ought to focus your journal on the nuclear arms issue. That way, you will get more support. Nuclear energy is still a debatable issue," so said a friend last year during a discussion on the contents and emphasis of *Anumukti*

I disagreed. Precisely because nuclear energy was 'still' a debatable question, it required a journal to air views contrary to the dominant paradigm. Does anybody need an argument to be convinced of the sinful horror, the utter futility and the terrible wastefulness of nuclear weapons, I wondered ?

A year wiser, I find myself devoting at least this number to the weapons issue. With my background in physics, I find the clamour for the Bomb among influential sections, extremely strange. Search the physics departments of any of our prestigious centres of learning with a fine comb and it would be difficult to find a genuine 'damn the consequences' probomber. But a casual glance at the 'humanities' departments or at that esoteric breed, the think tankers, reveals an embarassing profusion of such mis-(sile)guided enthusiasts. A few honourable exceptions apart, politicians, (as usual), take the cake. Ruling party rubber-stampers to oppose everything opposition disunionists, lily-white secularists to dyed in the wool communalists, Akhand Bharat centrallists to 'Sons of the Soil state rightists, the 'Aya Rams' as well as the 'Gaya Rams', horror of horrors even some 'Gandhians', all proclaim their love

for the Bomb. Mixed with their righteous horror at nuclear devastation, is the perpetual refrain, "But what are we to do if Pakistan builds the Bomb ?" The best they suggest is continuation of the present sterile and dangerous policies of nuclear ambiguity. One begins to wonder if all the contestents for the pilot's seat are Dr. Strangelove's clones

Tough-talking realists who occupy the corridors of power, have put us on a treadmill; making us run for all we are worth in an unending quest for arms (commisions). The weapons become obsolete with increasing rapidity and need to be replaced by ever more deadlier weapons. Instead of options remaining open, they arc foreclosed. The Bomb is the only option-our ticket to the 'Big' league.

Peace is a positive value. It is more than the mere absence of strife. Only in genuine peace can we work out the real problems : of hunger and poverty and disease and ignorance; of sustainable and equitable devolopment; of finding the root causes of violence within our society and without; of substituting cooperation instead of competition as the basis of existence. A world view which envisages no greater role for India than that of an emerging regional bully, just will not do.

Nuclear energy and nuclear weapons are a package deal. Have one and the arguments for having the other slowly become irresistable. After all making the bomb is just a small step when the long road of collecting material and know how has already been traversed. Inevitably it is also a step on the road marked not security but assured destruction. *Anumukti* as the name itself indicates stands for the unilateral rejection of both.

From being known as the land of the Budha to achieving notoriety as the land, on whose bomb Budha smiled is indeed a great fall. All the King's men and all the King's horsepower are not going to put us on that pedestial again. It will need all of us 'common' folk to accomplish this task.

Surendra Gadekar

LETTER BOX

I suggest that *Anumukti* may cover the whole Indian subcontinent and you may like to make such an announcement in your sub-title : A JOURNAL DEVOTED TO NON-NUCLEAR SOUTH ASIA, and perhaps ask for a few activists from neighbouring states to be associated with the publication.

A request : Please aviod fundamentalistic assertions e.g., in your editorial, p.2. "Hope lies in the vision of Gandhi, ...and Emerson - a world in which all creation can live together in peace and respect." In principle I agree with you and I have empathy with these views. But the opposition to nuclear technology is based on scientific findings, reasons, and calculations, -not merely on the emotive appeals of moral and/or humanistic arguments. Our task is to provide technoscientific basis for the moral reasoning of Gandhi, Tolstoy, Thoreau and Emerson.

Dhirendra Sharma, Delhi

I have just received the latest (June'88) issue of Anumukti. I must say that I am not always able to read it carefully. But I do glance through. I feel it is a very good effort and the standard of the journal is always good. You must never give up. I am sure it will improve further. The notices of future issues that you have given are quite exciting.

What I mainly wanted to write through this letter is that I liked your editorial *'Fire and Ice'* immensely. It is brief, precise and conveys the important point of orienting the young.

Natwar Thakkar, Nagaland

Daughter of the A-Bomb

Yuriko Hatanaka, 42, is a daughter of the Hiroshima atomic bomb. She was in the womb when the bomb dropped.

Yuriko has the mental capacity of a child of two. She can neither dress nor go to the bathroom by herself.

Her vocabulary consists of a very few and simple words. She spends her day looking at the picture magazines in her father's barber shop. "She loves to look at the pictures, but she cannot understand that these magazines only come out once a week," said her father, Kunizo. "She throws a tantrum when she has been through them all. She thinks that I do not want to fetch her some more."

Yuriko was a three-month foetus when the atomic bomb "Little Boy" devastated Hiroshima on August 6, 1945.

"My wife was pregnant, she was on her way to work when the bomb exploded," Kunizo Hatanaka said in an interview. She carried our little boy on her back. They were nearly three miles (4 km) from the hypocenter, and they only suffered superficial cuts from flying pieces of glass. Within two weeks both of them became ill from radiation, and my son was dead by the time 1 got back from army duty in early September.'

'My wife was an appalling sight. She bad lost all her beautiful long hair, and her gums would not stop, bleeding. But she was a strong woman. She went through with her pregnancy, and on February 14, 1946, Yuriko was born," Hatanaka said.

"As Yuriko grew up, we become aware that something was wrong. At three she could neither walk nor speak, We went to the American experts of the Atomic Bomb Casualty Commission in Hiroshima. They told us that Yuriko was an ordinary case of malnutrition."

"We went to a Japanese professor at the medical faculty of Hiroshima University. He was very nervous because at the time Japanese scientists were not allowed to conduct independent research into the effects of the atomic bomb. But finally he agreed to check Yuriko's condition. His diagnosis was 'microcephali-born with an abnormally small brain. Then we knew she would never be able to take care of herself."

In 1965 Japanese journalist Ohmuta Minora, **now deputy editor of the Hiroshima newspaper Chugoku Shimbun,got hold of the classified reports from the Atomic Bomb Casualty Commission.**

He disclosed that the commission had found 44 other cases exactly like Yuriko's. The children were all born within a few months of the blast,

"We joined other parents and formed the Mushroom Club", Hatanaka said. "With the assistance of the journalist, we started campaig ning for compensation."

In 1968, when she was 22, Yuriko and 23 other children were officially recognised as "Hibakusha"—atomic bomb victims. Yuriko now receives a monthly allowance of 104,000 Yen (about $400), less than half the average wage in Japan.

"Ten years later my wife started complaining about pains in her hipbones. Gradually the pain spread up her back and down her legs. A local doctor took some tests. A few weeks later we received the results: she was suffering from bone marrow cancer.

"I could not afford the expensive medicine and care, so I applied to have my wife registered as an atomic bomb victim in order to get free medical treatment."

"But my application was returned. The authorities needed more information. On December 23, 1978, my wife was finally recognised as a victim. She died the next morning, at the age of 57."

With tears in his eyes. Kunizo Hatanaka shows visitors a video recording of his wife's funeral.

"Every Sunday we visit the cemetery. Yuriko puts her head at the tombstone and says, Ear, ear. It means: I can hear my mother,

Thomas Bo Petersen is a Danish freelance journalist who specialises in Asian affairs.

***Courtsey : Asia-Pacific Environment Volsno* 2**

Notice

We have received complaints from some readers that they did not receive issue no 5 (April '88). This is the result of some postal foul up. Any subscriber who has not received this issue should write to the Varanasi addres of the Editor and we will send

a copy immediately. We regret the inconvenience caused.

A Call For Sanity

Adequate words are lacking to express the full seriousness of our present situation. For over 30 years wise and far-seeing people have been warning us about the futility of any war fought with nuclear weapons and about the dangers involved in their cultivation. Some of the first of these voices to be raised were those of great scientists. They have tried to remind us that there Could be no such thing as victory in a war fought with such weapons. So have a great many other eminent persons.

When one looks back today over the history of these warnings, one has the impression that something has now been lost of the sense of urgency, the hopes, and the excitement that initially inspired them, so many years ago. One senses, even on the part of those who today most acutely perceive the problem and are inwardly most exercised about it, a certain discouragement, resignation, perhaps even despair, when it comes to the question of raising the subject again. The danger is so obvious. So much has already been said..What is to be gained by reiteration »What good would it do now

Look at the record. Over all these years the competition in the development of nuclear weaponry has proceeded steadily, relentlessly, without the faintest regard for all these warning voices. We have gone on piling weapon upon weapon, missile upon missile, new levels of destructiveness upon old ones. We have done this helplessly, almost involuntarily: like the victims of some sort of hypnotism, like men in a dream, like lemmings heading for the sea, like the children of Hamlin marching blindly along behind their Pied Piper. And the result is that today we have achieved, in the creation of these devices and their means of delivery, levels of redundancy of such grotesque dimensions as to defy rational understanding.

I say redundancy. I know of no better way to describe it. But actually, the word is too mild. It implies that there could be levels of these weapons that would not be redundant. Personally, I doubt that there could. I question whether these devices are really weapons at all. A true weapon is at best something with which you endeavor to affect the behavior of another society by influencing the minds, the calculations, the intentions, of the men that control it; it is not something with which you destroy indiscriminately the lives, the substance, the hopes, the culture, the civilization, of another people.

What a confession of intellectual poverty it would be—what a bankruptcy of intelligent statesmanship—if we had to admit that such blind, senseless acts of destruction were the best use we could make of what we have come to view as the leading elements of our military strength !

To my mind, the nuclear bomb is the most useless weapon ever invented. It can be employed to no rational purpose. It is not even an effective defense against itself. It is only something with which, in a moment of petulance or panic, you commit such fearful acts of destruction as no sane person would ever wish to have upon his conscience.

There are those who will agree, with a sigh, to much of what I have just said, but will point to the need for something called deterrence. This is, of course, a concept which attributes to others—to others who, like ourselves, were born of women, walk on two legs, and love their children, to human beings, in short—the most fiendish and inhuman of tendencies.

But all right : accepting for the sake of argument the profound iniquity of these adversaries, no one could deny, I think, that the present Soviet and American arsenals, presenting over a million times the destructive power of the Hiroshima bomb, are simply fantastically redundant to the purpose in question. If the same relative proportions were to be preserved, something well less than 20 per cent of those stocks **would**

surely suffice for the most sanguine concepts of. deterrence, whether as between the two nuclear superpowers or with relation to any of those other governments that have been so ill-advised as to enter upon the nuclear path. Whatever their suspicions of each other, there can be no excuse on the part of these two governments for holding, poised against each other and poised in a sense against the whole northern hemisphere, quantities of these weapons so vastly in excess of any rational and demonstrable requirements.

How have we got ourselves into this dangerous mess

Let us not confuse the question by blaming it all on our Soviet adversaries. They have, of course, their share of the blame, and not least in their cavalier dismissal of the Baruch Plan so many years ago. They too have made their mistakes; and I should be the last to deny it.

But we must remember that it has been we Americans who, at almost every step of the road, have taken the lead in the development of this sort of weaponry. It was we who first produced and tested such a device; we who were the first to raise its destructiveness to a new level with the hydrogen bomb; we who introduced the multiple warhead; we who have declined every proposal for the renunciation of the principle of "first use"; and we alone, so help us God, who have used the weapon in anger against others, and against tens of thousands of helpless non-combatants at that.

I know that reasons were offered for some of these things. I know that others might have taken this sort of a lead, had we not done so. But let us not, in the face of this record, so lose ourselves in self-righteousness and hypocrisy as to forget our own measure of complicity in creating the situation we face today.

What is it then, if not our own will, and if not the supposed wickedness of our opponents, that has brought us to this pass

The answer, *I* think, is clear. It is primarily the inner momentum, the independent momentum, of the weapons race itself—the compulsions that arise and take charge of great powers when they enter upon a competition with each other in the building up of major armaments of any sort.

This is nothing new. I am a diplomatic historian. I see this same phenomenon playing its fateful part in the relations among the great European powers as much as a century ago. I see this competitive buildup of armaments conceived initially as a means to an end but soon becoming the end itself. I see it taking Possession of men's imagination and behavior, becoming a force in its own right, detaching itself from the political differences that initially inspired it, and then leading both parties, invariably and inexorably, to the war they no longer know how to avoid.

This is a species of fixation, brewed out of many components. There are fears, resentments, national pride, personal pride. There are misreadings of the adversary's intentions—sometimes even the refusal to consider them at all. There is the tendency of national communities to idealize themselves and to dehumanize the opponent. There is the blinkered, narrow vision of the professional military planner, and his tendency to make war inevitable by assuming its inevitablity.

Tossed together, these components form a powerful brew. They guide the fears and the ambitions of men. They seize the policies of governments and whip them around like trees before the tempest.

Is it possible to break out of this charmed and vicious circle? It is sobering to recognize that no one, at least to my knowledge, has yet done so. But no one, for that matter, has ever been faced with such great catastrophe, such inalterable catastrophe, at the end of the line. Others, in earlier decades, could befuddle themselves with dreams of something called "victory."We,' perhaps fortu-

nately, are denied this seductive prospect. We have to break out of the circle. We have no other choice.

How are we to do it *

I have, no illusion that negotiations on the SALT pattern—-negotiations, that is, in which each side is obsessed with the chimera of relative advantage and strives only to retain a maximum of the weaponry for itself while putting its opponent to the maximum disadvantage— I have no illusion that such negotiations could ever be adequate to get us out of this hole. They are not a way of escape from the weapons race; they are an integral part of it.

Whoever does not understand that when it comes to nuclear weapons the whole concept of relative advantage is illusory—whoever does not understand that when you are talking about absurd and preposterous quantities of overkill the relative sizes of arsenals have no serious meaning—whoever does not understand that the danger lies not in the possibility that someone else might have more missiles and warheads than we do but in the very existence of these unconscionable quantities of highly poisonous explosives, and their existence, above all, in hands as weak and shaky and undependable as those of ourselves or our adversaries or any other mere human beings: whoever docs not understand these things is never going to guide us out of this increasingly dark and menacing forest of bewilderments into which we have all wandered.

I can see no way out of this dilemma other than by a bold and sweeping departure—a departure that would cut surgically through the exaggerated anxieties, the self-engendered nightmares, and the sophisticated mathematics of destruction, in which we have all been entangled over these recent years, and would permit us to move, with courage and decision, to the heart of the problem.

Any path to peace, it will be argued would have risks involved. Possibly so. I **do not see them. I do not deny the possibility. But if there are, so what Is it possible to conceive of any dangers greater than those that lie at the end of the collision course on which we are now embarked And if not, why choose the greater—why choose, in fact, the greatest—of all risks, in the hopes.of avoiding the lesser ones**

We are confronted here, my friends, with two courses. At the end of the one lies hope—faint hope, if you will—uncertain hope, hope surrounded with dangers, if you insist. At the end of the other lies, so far as I am able to see, no hope at all.

Can there be—in the light of our duty not just to ourselves (for we are all going to die sooner or later) but of our duty to our own kind, our duty to the continuity of the generations, our duty to the great experiment of civilized life on this rare and rich and marvelous planet—can there be, in the light of these claims on our loyalty, any question as to which- course we should adopt

In the final week of his life, Albert Einstein signed the last of the collective appeals against the development of nuclear weapons that he was ever to sign. He was dead before it appeared. It was an appeal drafted. I gather, by Bertrand Russell. I would like to quote one sentence from the final paragraph of that statement, not only because it was the last one Einstein ever signed, but because it sums up, I think, all that I have to say on the subject. It reads as follows:

We appeal, as human beings to human beings: Remember your humanity, and forget the rest.

George. F. Kennan

George. F. Kennan was for a long time the U.S. ambassador to Moscow. He made this Speech on May 19, 1981 *while accepting the Albert Einstein Peace Prize. Portions of the speech have* ***been*** *edited for space considerations. The original is available from THE INSTITUTE FOR WORD ORDER 777 United Nations Plaza New* ***York, NY*** **10017.*U.S,A.***

Safeguards or Safethefts ?

It doesn t take much to make an atomic bomb. A few kilogrammes of Plutonium or enriched uranium and a little knowhow are the only requirements. With even graduate students making plausible bomb designs with publically available information, knowhow is no longer a problem. As the following two articles illustrate, plutonium too is no longer a problem. Today, nations have been clandestinely making the bomb. How long do we wait before terrorist organizations jump into the 'game.*

Recently, the Vienna-based International Atomic Energy Agency (IAEA) announced that during 1987 it "did not detect any anomaly" which would indicate the diversion of a significant amount of safeguarded nuclear material anywhere for military purposes. The statement is part of an annual ritual that the IAEA performs, in order to assure the world that there is no "misuse of facilities, equipment or non-nuclear material..."; in other words, that the non-proliferation regime it presides over is working smoothly ana no civilian nuclear material under safeguards is being clandestinely diverted to weapons programmes.

The agency puts out such a public statement as the conclusion of its annual safeguards implementation report (SIR), itself a classified document. However, it now emerges that such statements are a misrepresentation of the SIRs. The Green Alternative European Link in the European Parliament has for the first time made public the SIR for 1986 and a Dutch ecology group has quoted extensively from the SIR for 1976.

Summarised by the World Infor- . mation Service on Energy (WISE) in its news communique of June 10, the SIRs show that large quantities of nuclear material under the IAEA safeguards could in fact have been diverted for military purposes in a number of countries, that the IAEA has no reliable way of determining tht they were not so diverted and that the problems of policing nuclear **installations are so complex as to be virtually insurmountable within the present framework of surveillance**

Thus we cannot be reasonably certain that the existing system of safeguards is worthy of our confidence. Nation-states bent upon diverting and using "civilian" nuclear material to build nuclear weapons or "peaceful nuclear explosive devices" cannot be effectively prevented from doing so under the existing safeguard regime.

A Question Mark

This puts a big question mark over the nuclear Non-Proliferation Treaty of 1970. The NPT has been criticised as an unequal and discriminatory treaty. It is undoubtedly that. Equally significantly, however, the NPT must be seen as a treaty that could not have prevented vertical or horizontal proliferation.

Indeed, the very premises on which the NPT was based are questionable. Of the three premises, the first held that it would be possible to achieve a "cessation of the nuclear arms race at an e?rly date only if the nuclear powers "pursue negotiations in good faith". As should be clear from experience at least until the INF treaty, the nuclear arms race has only intensified over the past 18 years; even the INF treaty has been signed outside the NPT framework.

The second premise maintained that there is a clear technical divide between the peaceful and military uses of atomic energy, which can be defended by a regime of safeguards. In reality such a divide was the invention of the nuclear industry which has been involved in both nuclear power generation and weapons production. It is therefore more appropriate to see the peaceful and military atoms as Siamese twins. A separation between the two is a function not of technology, but of political intentions.

The final premise was that the non-nuclear weapons states could be prevented from going nuclear only if the nuclear weapons states agreed to make civilian

nucleic technology available to them under IAEA safeguards. The last 18 years should shatter that illusion: more than half, a dozen countries have become threshold or de facto nuclear-weapons states. The IAEA safeguards regime with all its inadequacies is part of this development. It is as inseperable from it as the clandestine transfer of nuclear-military technology and material by certain states to favoured clients.

Timely Detection

To return to the IAEA's SIRs, what emerges is the following. In 1986, the agency's objective of "timely detection of diversion of significant quantities of nuclear material" could not be achieved in as many as 37 per cent of all facilities under safeguards. The "timely detection" interval is estimated by the IAEA to vary between ten days and six months. A "significant quantity" (SQ) is enough to make-at least one bomb of the Hiroshima or Nagasaki type—estimated by the agency as 25 kg of highly (90 to 95 per cent) enriched uranium of eight kg of plutonium (with 95 per cent Pu-239 in it), but said by other experts to be as little as 10 to 15 kg of highly enriched uranium or 2 to 8 kg of plutonium.

The limitation of the detection process should be clear from the fact th?t IAEA bases itself on a 95 per cent confidence interval. This when it is dealing with facilities that may contain 1,000 SQs or even 10,000 SQs. A five per cent gap could represent up to 500 nuclear bombs—a veritable arsenal.

Year after year, the SIRs state that the inspection goal could not be attained. Thus, the 1976 SIR concluded that the safeguards objective could not be realised in 16 out of 34 light water reactors. In 1986, the numbers were 77 out of 134 LWRs. The report also admits that the procedure followed to measure "normal operating losses" in nuclear plants leads "to artificially low values for material unaccounted for (MUF) and makes it difficult to draw valid figures from the MUF figures regarding the possibility that diversion has occurred. It is known that the MUF tends to run cumulatively into hundreds of SQs.

The 1986 SIR is even more disturbing. It says that "of the 147 installations where surveillance equipment was used... surveillance failed to provide conclusive results... at 82". This is a high *($6* per cent) failure rate. The number included 15 installations out of the 18 where television cameras were used. In other words, the failure rate tends to be even higher (at 83 per cent) where the surveillance is particularly close. "The inadequacies... are particularly manifest in those situations where shipments or receipts take place, or where spent fuel is handled" (e.g. in reprocessing plants which can generate weapons-grade plutonium) in certain forms.

These are technical problems of surveillance. But there are plenty of "man-made" or "political" problems too, related to the unwillingness of governments or private companies to provide information or access in time. Yet others derive from a shortage of skilled manpower. Thus, "in seven states, the safeguarded national inventory was between 1,000 SQ and 10,000 SQ..."(i.e. very large)..." The inspection goal for agency safeguards is evaluated as attained in four of these states" (i.e. not in the other three)... The main reasons for the failure are: "incomplete verification... and the fact that the material reported as shipped but not confirmed by the receiving state as received excee-ded one SQ."

A SIPRI study speaks of the "customary practice of refusing IAEA inspection access to the cascade area of the ultracentrifuge enrichment facility, a restriction rationalised by the desire to protect industrial secrets and recognised as legitimate in IAEA statutes." There have been instances of operators refusing to remove seals on nuclear containers for warranty reasons. Without removing the seals,

it Is not possible, to analyse the material.

The SIR also states: "The cooperation of states is needed in ensuring adequate and uninterrupted illumination in areas covered by agency surveillance devices." This resulted in "inconclusive surveillance results'.' in six installations in 1986. In other words, the operator can switch, off the power supply at a critical juncture and make sure that the IAEA cameras record nothing.

There are "problems in the deployment of manpower, largely due to insufficient flexibility of inspector designation restrictions." This made it 'necessary to concentrate efforts on the verification of quantities of nuclear material", giving the timeliness requirement the "secondary priority". This cannot possibly promote the inspection goal. Also ' there were seven states whose major problems arose mainly because they accepted fewer than the number of inspectors judged to be the minimum necessary".

Anomalies Explained

The report says that about 270 **'discrepancies or anomalies were found in 1986 *(160* in 1985) and most were "satisfactorily explained.." However, "in some of these cases, the inventory cannot be re-verified." Among the states that figures prominently in the IAEA report but is not named is West Germany where the inspection goal was not attained in 22 out of 38 facilities.- West Germany is incidentally the home of Nukem, which has recently figured in major scandals.**

Examples like these can be multiplied. What they show is that even an agency committed to the promotion of nuclear technology and closely allied with the nuclear industry has found it impossible to implement effective safeguards against proliferation. The divide between the peaceful and military uses of the technology is so fragile that a government bent upon diverting nuclear material cannot be physically stopped from doing so. The sooner the NPT and the IAEA regime are replaced by another arrangement the better it would be for the world.

Courtsey-Prafula Bidwai* : *Times of India.

"A Very Exciting Business"

'Eric' is a plump middle-aged man who at first glance appears quite unthreatening. But until three years ago, this man was a high tech arms dealer, illegally supplying both South Africa and Argentina with sophisticated military technology. He was also involved in an even deadlier trade, the sale of plutonium. He, and others like himself, are middlemen in the worldwide trade in plutonium, where the raw material for nuclear bombs is sold to anyone who wants, and can afford, to buy it. For Eric, it was a "very exciting business".

***The* story of Eric, a Belgian wanted by the police in three countries, is told in a remarkable documentary which was shown on BBC's Channel 4 television's "Dispatches" programme in late 1987 in the UK. It made public the first insider evidence of the existence of a nuclear blackmarket in weapons grade materials, a market whose existence has always been denied by the nuclear industry as well as the International Atomic Energy Agency.**

Eric, who asked the makers of the documentary not to use his last name, dealt regularly throughout the late. 1970's and early 1980's in smuggled nuclear technology, later entering the market for weapons grade material itself-both plutonium and enriched uranium. As a dealer, he supplied much of the hardware used in Argentina's nuclear programme. In late 1983 he was told proudly by a retired admiral responsible for one of Arg entina's high-tech research labs that Argentinahas it's first nuclear device. Since, then, lie's heard that they have had a second one since 1986. Argentina, needed

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to use black-market plutonium to develop its first device given the estimated output of its nuclear power programme at that time. Eric acknowledge! this, saying Argentina bought not only black market technology, but was buying mostly plutonium at the beginning of its involvement in the nuclear black market.

It was Israel, says Eric, which originally set up the black market. As long ago as 1965, 250 kilos of enriched uranium were diverted to Israel from an American plant. Israel has also long been suspected of several other diversions including, according to the documentary, the 1968 hijacking of a ship carrying uranium. In fact that case, known as the "Plumbat Affair", involves more than mere "suspicions". It is now generally acknowledged that the highjacking, in which zoo tonnes of concentrated uranium were stolen, was carried out by the Mossad, the Israeli Secret Service (see WISE NG 281.2833). By the time the Israelis had obtained enough material to carry out their own weapons programme, and their own technology was advanced enough not to need the black market anymore, there was a well developed network in place which was not going to just disappear because the Israelis no longer needed it. The people in the middle were not going to simply give up what Eric calls "such a nice operation.

The black market is based in Khartoum, the capital of Sudan, where a quantity of enriched uranium was seized by police last August. The documentary includes an interview Captain Assem Kabashi, a former officer of the Sudan State Security Organisation which provides details of how it operates. Indications are that in addition to Israel, Argentina and South Africa, countries involved in the black market include Libya, Brazil, Iraq, Iran, Syria, *Pakistan and India.* Following the August seizure by the police, Sudanese Prime Minister Saddiq al Mahdi admitted the existence of a nuclear black market and the involvement of prominent Sudanese busin esesmen - an admission which led to a growing political scandal implicating the Prime Minister's own family; Kabashi, who wrote a series of articles on the Khartoum connection which appeared in the Sudanese Press after the Prime Minister's admission, was arrested, but later secured release through former colleagues in State Security and went into hiding.

Kabashi's articles revealed that the Sudanese dealers involved in these sales, some of whom were his former colleagues at State Security, had contacted a number of foreign countries, including Israel, through a syndicate in Italy. Eric, who says middle-men exist in France, England and Belgium, also confirms the existence of the Italian group. He says the Italians closed a deal for the sale of plutonium some 12 months before the documentary was made. The Italian group also had enriched uranium which they sold later on, as well as the batch of enriched uranium that was on sale in Khartoum in mid-August. In addition to Israel (which bought 2 kgs), buyers in the mid-August sale included, Ir?n (1 kg) and Iraq (2 kgs). With the Iraq/Iran war now in its eighth year, those countries are locked in a race for the bomb. The technology of weapons manufacture is well known and available to both countries. What they are now concerned with is the acquisition of weapons-grade material.

The documentary says that all together, at least six consignments of black market nuclear materials have passed through the Sudan since 1980. They include 12 kgs plutonium tested by South African experts and supplied to Iraq and a consignment of plutonium sent to an unknown destination in 1982.

According to former US .Central Intelligence Agency (CIA) Director, Admiral Stansfield Turner, who was interviewed in the course of the documentary, the source of the material for the black market is civilian nuclear plants. The documentary further pointed

out that, the most likely area where diversion- could occur is in the commercial reprocessing, and shipment of plutonium, (The danger posed by shipment has been substantially illustrated by the Transnukler scandal in Germany, see *WISENC* 286,2897. *Anumukti vol. 1 no* 4)

Most of the commercial sources for plutonium are now in Europe. Although there has been strong urging from the US for European plants to cut production of weapons grade material, the British, Germans and French have instead made plans for a huge expansion of production, resulting in large consignments of plutonium being transported around Europe, vulnerable to attack or theft. • (Despite its urgings, the US has potentially increased the problem with its pact with Japan which will allow reprocessing of US-controlled spent fuel in France, the UK or Japan, see WISE NC 278.2388 and 278.2387.)

Already, at the Dounreay Reprocessing Plant in Scotland, there has been an accumulated loss of more than six kilos of plutonium since 1980. During the same period there was an accumulated loss of over 20 kilograms of high enriched uranium. At the Sellafield reprocessing plant in Cumbria, UK, there have also been regular **shortfalls in plutonium stocks over the years. To compound the problem, the material accounting system- in these plants has a margin of error, which would allow a skilful diverter to remove material so that it would not even be missed. International safeguards to prevent civil plutonium from being diverted are, to say the least, flimsy. The IAEA, responsible for verification that countries have not acquired nuclear weapons, claim so far not to have found any case of diversion of fissionable material. Clearly, their 'safeguards' are incapable of handling the present situation. So how are they going to handle the new situation posed by the projected increase in plutonium production in Europe which will likely mean that there will soon be a surplus on the nuclear black market, increasing the risks even more. As if that wasn't problem enough, what is IAEA or anybody else going to- do about an even more frightening new development in the nuclear black market t According to Eric, the "supplying side", as he calls it, is trying to establish a new approach which would be to manufacture kits with everything you need to assemble your own bomb. You could buy it "lego", he says.**

Couttsev : WISE News Communique

Nuclear Policy Thy Name is Hypocracy

For about two decades after Hiroshima and Nagasaki, countries which wanted to become nuclear weapon powers were frank and honest about their intentions. The United States, the Soviet Union, Britain, France and China assertively developed their nuclear weapons programmes. Even Sweden declared its intention to become a nuclear weapons power but it gave up the programme under US pressure as well as because of the rising anti-nuclear popular sentiments in Sweden.

The US pressure oh Sweden to desist from making nuclear weapons illustrates the beginning of the non-proliferation regime and its exact opposite; namely clandestine nuclear weapon programmes by various countries. The cause of the horizontal non-proliferation was espoused by the super Powers and their allies because, by the late 1950's, they came to realize that nuclear deterrence was a "two person game"; the entry of a "third 'person" completely destabilized deterrence even for the two primary players. Britain and France could somehow be accommodated in the US "person" but China, having split from the Soviet Union, could not be. Hence strenuous attempts were made to prevent China from developing its nuclear weapons but they were not successful. Both the super powers reluctantly accepted China's entry into the "nuclear club" but they

redoubled their efforts to prevent any further' 'proliferation. That left clandestine development as the only way out for nuclear ambitious countries.

The ambitions of such countries are difficult to check despite the best efforts. The first attempt came in the form of the Nuclear Nonproliferation Treaty; non-nuclear countries were induced to join it through a mixture of inducements and threats. But several refused to sign the Treaty giving highminded reasons. This was followed by the imposition of International Atomic Energy Authority (IAEA) safeguards on countries which wanted to build nuclear power stations. This regime was further reinforced by a group of 12 .countries coming together (informally called the "Club of London") which prevents the sale of nuclear materials outside the IAEA safeguards regime. All such efforts have registered only a limited success.

The most difficult problem about preventing proliferation is that the technologies for nuclear power generation and for producing weapon-grade fissile material are almost identical. While nuclear weapons have generally evoked feelings of horror, the generation of electric power based on the heat generated by a nuclear reactor has been largely accepted as benign and desirable. In countries such as ' India where the potential for developing coal or oil based thermal power or even hydro-electric power is limited, nuclear power generation .is considered by some as the only way out if the growing energy needs of the country are to be met.

In recent years, nuclear power generation has been subjected to a great deal of criticism. The per kilowatt hour capital costs of nuclear plants are escalating rapidly. Safety has always been a problem but since the Three Mile Island near-disaster and the Chernobyl actual disaster, public anxiety about nuclear power plants has grown tremendously. The storage and disposal of nuclear wastes from the plants is becoming a pressing problem as nuclear power stations grow in number and run for longer periods. Above all, some plants are now approaching the end of their useful life and the problem of decommissioning them have yet to be solved; even after entombment", they may have to be guarded for the next 2000-3000 years For all these reasons, ambitious plans for nuclear power (generation are being cut down drastically in the industrialised countries. In 1974, the plans envisaged the production of 4.45 million megawatts of nuclear power generation by the year 2000. But now the projection has been cut down to 0.4 million megawatts or less than 10 % of the original target. Some countries are cancelling all the new plants on order.

But the turning of the nuclear energy tide is taking place only in the highly industrialized countries. In the Third World, the expansion plans remain unaltered. In India, for example, the Atomic Energy Department is deter-, mined to go ahead with its plans despite horrendous cost-escalations, very serious time-lags, enhanced doubts about safety and the mounting problems of nuclear waste management.

If power generation were the sole objective, it can be achieved relatively quickly and efficiently by building the plants with foreign technology under IAEA safeguards* This the Government of India has ruled out for future plants. The high-minded principle behind this is self-reliance and rejection of discriminatory teatment. These are laudable principles but they are evidently not applied to other sensitive areas. For instance, the high technology weapon systems in the armed forces are almost wholly imported. High-speed computers are imported despite discriminatory conditions.

If power generation is the only aim, why the tremendous secrecy surrounding the operations of the nuclear plants In fact, except for the locations of the plants and their generating capacities, no other important detail is made known. The size of the uranium stockpile, the

quantity of plutonium generated and of Pu-239 separated from the burnt fuel, even the total quantity of heavy water available and their sources are matters of speculation. The government- has also resisted the establishment of an independent regulatory authority. Power generation should be at least minimally a commercially viable activity but in India it is treated like a military undertaking where money and other resources are sunk for such intangible benefits as technological self-reliance, national prestige, etc.

Obviously, power generation and other peaceful, applications of nuclear energy can not be the sole aim. Our leaders are, of course, perfectly aware of this although they steadfastly maintain the public posture of peaceful uses. Occasionally, we get a glimpse of the truth such as when Rajiv Gandhi declared in Paris in 1985 : "If we decide to become a nuclear power, it would take a few weeks or a few months". Such a switch from peaceful use to warlike applications within "a few weeks or a few months" is possible because "peaceful use" takes a country nearly nine-tenth of the way to acquiring usable nuclear weapons.

There arc at present two routes available to operate a "dual purpose" nuclear technology which can yield energy or weapons or both. The first route followed by the US and many other countries uses enriched uranium in a light water reactor. Tarapur is one example of this. In this method, the uranium metal is first "enriched" by separating the fissile isotope U-235 from the non-fissile U-238 and increasing the concentration of U-235 to about 4-5% which is then used as a fuel in the reactor. This is an expensive and difficult technology but if mastered, it enables an enrichment to levels above 90%; this is weapons grade material.

India has taken the second route. This uses natural uranium and the reaction is moderated with heavy water. The two major advantages of **this method are that (a) it yields Pu 239 (U 238 is converted to Pu 239 due to irradiation); and (b) the reactor can be recharged with fresh fuel while in operation. Weapons grade Pu 239 can be produced by separating the Pu-239 chemically from spent fuel. This is a relatively cheaper method than the uranium route. What is more, a lesser amount of Pu-239 is needed than U-235 for making a-nuclear weapon. The plutonium route is, therefore, the preferred route for a clandestine weapons programme..**

Once fissile material has been obtained in . sufficient quantities, the identity between the peaceful and weapon production technology ceases. The production of the weapon itself is an area of explicit military technology; Rajiv Gandhi's reference to "a few weeks or few months" was about this part.

Nuclear power generation, particularly by the natural uranium-heavy water route, allows sincere declarations of "peaceful use" which can not be challenged on technical grounds. Similar declarations about the space programme also can not be challenged on technical grounds because rockets used for peaceful applications and warlike purposes are almost identical. Only the last stage differs in terms of pay load, guidance, re-entry capabilities and so forth. Until the two programmes are demonstrably married, it is possible to maintain with a straight face that both are devoted to peaceful uses.

But it is not all a matter of maintaining peaceful pretenses. The nature of nuclear fission technology is such that nuclear plants, even if they do not produce bombs, are themeselves bombs of a deadly nature. This is not only because they may blow up for some non-nuclear reason. They become bombs in the event of an enemy attack on them. Such an attack need not be one with nuclear weapons ;a conventional attack is just as deadly. Almost everything in a nuclear power station is

radioactive. The quantities involved ire many order of magnitude larger, than the radiation ' released by a bomb, (people have returned to Hiroshima and Nagasaki but decommissioned power stations must be entombed for' 2000 years.) Moreover, nuclear power plants are generally built in clusters; in that sense they are like nuclear ammunition dumps.

Modern conventional penetration bombs can break through thick concrete shielding. The Osiraq reactor in Iraq was destroyed by Israel in a conventional attack. Locating the nuclear power stations away from the border with a hostile country will no longer guarantee safety because long-range missiles are being developed or acquired by many countries and there is no real defence against them.

All in all, nuclear power plants, contrary to the pious declarations of "peaceful use", are not only dangerous in' themselves but they lend themselves to warlike uses. Moreover, they. are attractive targets for attacks, by an enemy who has no nuclear weapons but can convert the plants themselves into nuclear bombs on one's own soil. Why then is the fiction of "peaceful uses maintained It does not fool other countries. Perhaps the political leaders and their scientist allies believe that their ignorant fellow-citizens can be more successfully fooled.

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"Usual Occurences"

Acording to a report by the British Royal Navy, more than 700 "incidents" took place on British submarines powered by nuclear reactors during their first 16 years of operation 1962-1978). The "incidents" ranged from faulty routine tests and minor errors of seamanship to the kind of accident which nearly crippled HMS Resolution, a polaris submarine, at the Scottish submarine base of Faslane on the Firth of Clyde. The 'Resolution' incident was described as a "little fault" by the British Defence Ministry, but the Resolution's reactor was actually within minutes of "dis-figuration", the first stage of a core melt-down, before the crew succeeded in reactivating the cooling system. One of the crew members involved had to be scrubbed down for 24 hours after exposure to radiation resulting from the accident.

An analysis of 435 of the 712 incidents, carried out at the nuclear department of the Royal Naval. College at Greenwich, found that 205 accidents were caused by mechanical problems, 107 by operator error, and 123 by primary or secondary electrical faults, presumably not unlike the "minor electrical malfunction" which occurred on the Resolution. Captain Jim Bush, a nuclear veteran now working at the Centre for Defence Information, a private US think-tank frequently critical of Pentagon policies, estimates that perhaps a dozen of these incidents resulted in the release of radioactive material.

A typical submarine reactor can generate 70 million watts, enough power to run a city. However, safety measures for reactors at sea are not as strict as those for nuclear plants because danger to the public is considered to be less. At the British base at Plymouth, for instance, the safety-zone for any reactor accident is only 500 meters wide. To compound problems,'safety of the ship itself and the perceived need for speed and endurance leads those in charge of operation to maintain power

at **tea** in circumstances when a land-based reactor would be shut down.

The dangers caused by these "swimming reactors" have been neglected by the anti-nuclear movement for too long. The leading naval powers now have between them nearly 400 nuclear-powered warships. Canada, India and Brazil also have plans for nuclear powered vessels. In fact, in addition to the third of all nuclear weapons that are sea-based, more than half of the nine hundrded reactors on earth are somewhere on the seas.

The US Navy has already lost one nuclear-powered vessel and according to the Guardian (the British newspaper which released news of the Navy's report), the Soviet fleet has "almost certainly lost several in addition to an accident when missile fuel blew up Inside a nuclear submarine off Bermuda in 1986." Meanwhile, the Pentagon claims that "in over 3,100. reactor years of US naval reactor operations there has never been a reactor accident or a problem resulting in fuel damage." (The loss of a reactor along with a ship doesn't seem to. count as a "reactor accident"...) But according to William Arkin,. a defence analyst at the Washington-based Institute for Policy Studies, sources within the US navy admit to serious incidents in nuclear submarines, where crew members .have been hospitalised and submarines required to surface to deal with reactor problems. In relation to the Soviet fleet, Arkin estimates the rate of significant incidents at 200 over 10 years.

***Source : WISE News Communique* : 289.2940.**

NUCLEAR DUMPING

The Irish environmental organisation, Earthwatch, has called on the Irish government to use the London Dumping Convention to prevent Britain from dumping obsolete nuclear submarines off the south-west coast of Ireland. According to the Sunday Press (Ireland, 24 Jan. 1988), the British government is considering filling the submarines with concrete and dumping them, complete with their 850-ton reactor units, on the seabed.

The problem of what to do with old, nuclear-powered submarines is becoming ever more pressing. Britain's two Valiant Class submarines will have to be scrapped in the next four to five years and the four Polaris "R.' class vessels are due to be phased out in the next ten years. The most urgent, however, is the already obsolete 3,000 ton HMS Dreadnought, currently lying in **a** "secure berth" at Rosyth, on the east coast • of - Scotland.. - The as-year old vessel was formerly powered by an American-built pressurised water reactor, which is still on board. The alternative to establishing a radio-! active cemetery conveniently distant from Britain is to store it on land in Britain, a strategy which would also meet a lot of opposition. It has been estimated that the cost just to remove the reactor would be in the region of 15 million Pounds and this takes no account of the huge expense that would be involved in transferring it to a safe burial site-if such a thing could eves be constructed.

Under the London Dumping Convention, a moratorium on all dumping of radioactive wastes at sea was introduced in 1983. .However, the British government argued that the moratorium was non-binding and intended to go ahead with its dumping plans .for that year. At that time, the British National Union of Seamen refused to handle the waste. However, **a** union embargo would:not prevent.the.proposed dumping, of nuclear submarines, which

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Would be carried out by tie British Navy.

Earthwatch is calling on the Irish government to seek international support before the next meeting of the London Dumping Convention (3-7 October 1988) for a fully binding moratorium on nuclear dumping. Already a proposal has been put forward by Nauru, a tiny Pacific island nation, calling for all radioactive substances to be placed on Annex I of the Convention. This is the so-called "black" list of substances, dumping of which is banned in all circumstances. As this would involve an amendment to the Convention itself, it would require a two-thirds majority of the countries represented.

According to Earthwatch, over 150,000 tonnes of radioactive waste has already been dumped at the North Atlantic dump site approximately 400 nautical miles to the south-west of Ireland. The most conservative estimates suggest that over 1,000 deaths, cancers or major genetic deformities among present and future generations will result from this waste, peaking in about 80 years.

John O'Halloran of the Irish National Cooperative . Council, which has also urged the Irish government to protest about the plan, believes that the dumping plan has been prompted by a recent medical survey of 60,000 Scottish children. Of 43 cases of Fife, twelve were in Rosyth, where HMS Dreadnought is berthed. Fifteen cases were found in the neighbouring village of Levenmouth.

An Earthwatch spokesperson said, "Dumping of nuclear waste in the oceans causes cancers and genetic defects among populations who receive none of the benefits of nuclear technology. Earthwatch believes that all radioactive waste should be stored on land in the country in which it was produced. The nuclear industry must face the reality of what it has created. The British proposal...is based on domestic political consideration rather than environmental or radiological criteria. Instead of reconsidering the ocean option, the British government should respond to the inevitable public opposition to land-based disposal by scrapping its nuclear programme.

Source : WISE News Communique.

•Half-Life'

The Marshall Islands are a part of a complex of 2000 islands in the Pacific that collectively comprise Micronesia, inhabited by 160,000 indigenous 'native' (Adivasi) people. During the second world war, these islands were occupied by the Japanese. After the war, they were taken over by the U.S. as U.N. mandate territories. Today, strategically they are important bases for the U.S. domination of the entire Pacific region. In addition since the first 'human testing' of the atomic bombs on Hiroshima and Nagasaki, the U.S. has used Marshall Islands in particular as a site to test its latest weapons of mass destruction. The same **is true of the French who first began nuclear testing in North Africa in early 1960 s. After Saharan independence the French just shifted their testing site to their possesions in the Pacific-Moruroa for example, where they continue their business as usual even to this day. The Americans justify their actions by pointing to the fact these islands are inhabited by only a 'few' people. As Henry Kissinger said, "There are only a hundred thousand people out there. Who gives a damn "**

Editor's Note : The same attitude is characteristic of all nuclear weapon's powers. It is also shared by exploders of 'peaceful nuclear devices'. Due

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a the feat of 'fall-out' nuclear testing can only be done in very sparsely populated regions. These places are populated by Adivasis who anyway nave very little political voice - who don't count a damn. In fact, not only nuclear weapon's testing but the whole nuclear fuel cycle, from uranium mining to nuclear waste disposal is an assault on Adivasi existence. We shall document this in future issues of *Anumukti*.

Dennis O'Rourke, an independent Australian film maker has made a powerful film titled *Half-life*. It deals with the effects on the Marshall Islanders of the first U.S. open air hydrogen bomb test in 1954, code named "Bravo". He has used declassified U.S. documents and direct interviews with the personnel involved in monitoring weather conditions for the test, to show that the indegenous population was deliberately experimented upon and used as radiation guinea pigs.

For forty-eight hours the people on Rongelap island were told nothing about the radiation effects of this first 'dirty' hydrogen bomb. The children,, who had never seen snow, played in and with the white radioactive fall-out-snowflakes. Soon after this first exposure men, women and children started becomming sick. The U.S. medical and military authorities deliberately kept people in the dark, reassuring them that their land, waters, fishing and food were not contaminated. This, despite the evident symptoms of radiation sickness.

For three years, from 1954 to 1957, U.S. forcibly exiled the Rongelap Islanders to other islands in the region. They were permitted to return and 'live' on their island thereafter. Over the next years, the awful consequences of radiation contamination were passed on through the biological chain. Numerous women either aborted or had malformed children. Bven after their return in 1957, the Rongelap women still experienced a stillbirth and miscarriage **rate twice that of other Marshallese women who had not been exposed to the fallout. Of the twenty-two Rongelap children exposed to the fall-out, nineteen have had to remove thyroid nodules surgically. All the while the authorities were pretending that this was nothing abnormal.**

The title of O'Rourke's film aims to capture the fact that radiation effects last forever in nature. In physics and biology, a 'half-life' is a unit of calculation tor the period of time required for a quantity of radionuclides to break down by half. In reality however, calculating 'half-lives' is a way of institutionalizing permanently damaging effects. The film captures very well the destruction of the indegenous Marshall Island's culture by technological totalitarianism. It brings out the contradiction between two. incompatible ways of life. One based on imperial arrogance-your land is ours and that we have a right to dominate, manipulate and even destroy you, your resources, your relation to land and nature in our God-given interest, as we conceive that interest. The other based on a radically different, harmonious relationship with nature.

After suffering the irreversible physical and social effects of this radioactive 'half-life', the Marshall Islands' culture is no longer viable. Just as the natural soil, sea and water systems are in decay,so is their culture of integrated harmony with nature. In addition to the physical and biological effects of the 1950's tests which continue to this day, there are also equally traumatic psycho-social effects : the region's suicide rates, for example, are among the highest in the world. The people have no sense of meaning in their lives because they have literally been dispossesed, uprooted from the natural condition of existence. In particular, far from being able to sustain any form of natural economy, the people remain dependent-for their very existence on imported U.S. Junk - literally Coca-Cola and McDonald's hambergers. One of the

things to moving about 'Half-Life* is the portrayal of how, from defensive necessity, in order to survive, the indegenous victims have to adapt to these antinatural conditions.

In the United Nations trusteeship agreement under which the administration of the Marshall Islands'was handed over to them, the U.S. government had pledged : "To promote the social advancement of the inhabitants and to **this end shall protect the rights of and fundamental freedoms of all elements of the population without discrimination; protect the health of the inhabitants"**

Sources **: Interview of Patrick Flanagon by Jenny Dowell for the Barcelona periodical *Integral. (The Monthly Review* January '88)**

H.Wasserman & N. Solomon : *Killing Our Own* Dell Publishers '82

The Spirit of Belau

Belau is a group of about two hundred islands 8ooKm. east of the Philippines in the Pacific Ocean. Belau with a population of just 15,000 people has become famous for being the world's first nation with nuclear free provisions written expressly into it's constitution. But this is exactly the reason why this small Pacific island is no longer pacific.

Belau was a Japanese base during world war II. In 1947 it was placed under U.S. administration as a United Nations trust territory. It became a republic in 1979. It was the first country to have a nuclear - free status written in the constitution. The constitution was adopted by a 92% vote in a referendum. The clause guaranting the nuclear-free status could only be overturned by a majority of not less than 75 % in a referendum.

The Pacific Ocean has become a testing ground for nuclear explosions and missile tests in the last few decades. With the 'fall' of Indochina, the Philippines and Guam remain the only U.S. strongholds in East Asia. Among these, the fate of the bases in the Philippines whose status is being renegotiated is uncertain. There has been a rise in antinuclear sentiment in the Philippines and its senate has voted strongly in favour of a nuclear-free status. Thus, Belau-a tiny island with a small population, which can be pressurized easily, has assumed importance to U.S. military planners.

Unfortunately for them, the nuclear-free provisions in Belau's constitution **prevent the development of a base at which nuclear powered and armed ships can berth. However, such niceties have never prevented the military anywhere and especially the U.S. military from getting what it wants. To them, the Pacific Ocean has always been an American lake.**

Hence, since 1979, economic and political 'screws have been tightened' by the US. President Haruo Remeliik, who was a strong supporter of the constitution was murdered in March 86. The new president, Lazarus Salii declared a state of financial emergency and fired two thirds of the government employees without pay with the promise that they would be reinstated with back pay after the amendment of the constitution. Other pressure has included cuts in electricity, water and hospital services. The homes of several pro-constitutionalists have been fire-bombed. The referendums to amend the constitution have been held repeatedly (8 so far), Extreme right-wing organisations like the Unification Church and the World Anti-Communist League have extended their activities to Belau.

The latest referendum was held on August 4, 1987. in an atmosphere of mob violence. In it 71% voted for a constitutional amendment to eliminate the provision which said that a majority of 75% was needed to amend the constitution. So on 21st August 1987, a simple majority was sufficient to overturn the nuclear-free provision in the constitution,

The. legality of this referendum was challenged in the courts by a group of women elders under the leadership of Gabriela Ngirmang. This suit was, however withdrawn shortly due to intimidation of the plaintiffs and witnesses. Only after receiving assurances of protection from the U.S. congress, the suit was refiled in March '88. On April 23rd Judge Robert Hefner ruled in favour of the women elders and held the constitutional amendment invalid.

It is not known what happens next. As an American television commentator said, "if Belau is allowed to retain it's nuclear free status, it could spread like a virus throughout the Pacific and that would be against the U.S. national interest." The fight shall go on. The spirit of Belau lives on.

***Sources* : *Kalinga Senaviratne in Lanka Guardian X*, 20 (15.2. '88)**
***WISE News Communique no*. 295, 293, 291, 290 & 278.**

Already Off The Brink ?

Little more than a year ago, in March '87, Dr. Abdul Quader Khan comprehensivly beat us 'all ends up' with a googly or was it a chinaman. Pakistan's Bomb was announced not with a bang but an interview. The spate of confirmations, denials, counter-denials followed by border belligerance and cricket diplomacy was enough (as intended) to confuse almost everybody.

So, what is the situation with regard to the South Asian bombs Has the starter's gun already blown for the nuclear arms race in the subcontinent Unfortunately, as is the norm in everything about ourselves, one has to turn to foreign sources for information.

According to Mr. Leonard Spector, who has been compiling an annual report on the nuclear scene in the threshold countries, for the Carnegie foundation, the answer is yes.: there are bombs in the basements of both countries. Though neither country according to him has as yet taken any steps to 'operationalize' nuclear weapons.

Dropping a nuclear bomb from an aeroplane calls for special procedure. After zeroing in on the target area, the aircraft must go into a steep climb immediately after releasing the bomb and turn sharply backwards to escape the after effects of the blast. This being the case, any country planning to use bombers for this purpose would have to set apart men and machines for this purpose. Pilots will have to be selected for skills and political reliability. The earmarked aircraft will have to be segregated and specially protected. A special chain of command will have to be created between the ultimate political authority and the designated unit. Training will require dummy bombs exactly duplicating the size, shape and weight distribution of the nuclear device. It is doubtful if all this can be kept secret from several intelligence agencies which are undoubtedly looking for tell-tale signs. This suggests that neither India nor Pakistan has yet moved to the stage of putting nuclear devices into operational arsenals - unlike Israel which has certainly inducted nuclear weaponry into its armed forces. Mr Specter goes on to assure us that, "I would be surprised to find any Indian or Pakistani military personnel playing at this stage any role in nuclear preparations. The nuclear establishments in both countries are, so far, the only ones involved along with political authorities. My fear is that the current situation of a developed, but not operational nuclear capability wouldn't last". The ambiguity about what each has in mind may compel the other side to assume the worst, and take its own steps accordingly. This might create an unintended chain reaction which relentlessly pushes both beyond the nuclear threshold.

What does having bombs in the basement mean *i*

la India's case it means that work has gone on in refining bomb design - miniaturizing the warhead to permit fitting to a missile. The plutonium needed to make the bombs is already available in plenty and so is the knowhow to convert it into bombs. However, there is no hard evidence of a programme for the production of a nuclear arsenal. Some people though, in the U. S. intelligence community have suspicions that India is building at the rate of 20 bombs per year.

By mid 1986 onwards, weapon's grade enriched uranium first became available to Pakistan from the Kahuta enrichment facility. It is estimated that by early this year enough has been accumulated for four to six bombs.

Along with nuclear energy the other high-tech frontier area with lots of peaceful' applications is space **technology. India has already sucessfully tested its own indegenous surface to surface missile 'Prithvi' with a range of 250 Km. Pakistan has access to Chinese M-9 missiles which have a 600 Km. range. China has sold the missile to Saudi Arabia and has shown it at air shows with the purpose of selling to anyone interested. A marriage of these two 'peaceful' technologies is not difficult to arrange. It would mean that cities like Delhi, Lahore, Bombay and Karachi amongst others would be just a few minutes away from oblivion, with no other defense except the mutual good sense, maturity and the survival instincts of their respective political leadership. Good night and sweet dreams.**

Source : ***"South Asia's N-bombs not yet operational" by Dilip Mukherjee, Times of India July*** **8,1988.**

Anatomy of Nuclear War

The date August 6, **1945.** ***The Place - Hiroshima, Japan.***

"No one could understand what had happened. Thousands began to flee the city. Most of them seemed to be hurt or maimed. Eyebrows were burned off, skin was hanging from faces and hands many were vomiting. Almost all had their heads bowed, looking straight ahead, were silent and showed no expression whatsoever. In general, survivors that day assisted only their relatives or immediate neighbours, for they could not comprehend or tolerate a wider circle of misery.

Towards evening the streets became quieter-, "Now not many people walked in the streets but a great number sat ana lay on the pavement, vomited, waited for death and died." Even now there was no organised help; masses were dead, masses were dying. "They all felt terribly thirsty and they drank from the river. At once they were nauseated and began vomiting and they notched the whole day'' There were a few people who were capable of helving otliers. Survivors that evening noted that the asphalt on the streets was still too hot to walk on with comfort. Two men noticed "a pumpkin was roasted on the vine", which was eaten. Potatoes under the ground were found to be baked and were gathered for food. Many desperately ill survivors found their way to the sand pits on the river deltas. The tide was coming in. Many were too weak to move themselves but were helped by exhausted survivors. "He reached down and took a woman by the hands, but her skin slipped off in huge glovelike pieces." Others were moved up the sand pit but the following morning they had gone as the tide had came higher than expected. Hiroshima, by John Hersey.

Today, with the "live" experience of Hiroshima and Nagasaki a great deal is known about the medical consequences of a nuclear attack. A nuclear bomb explosion involves blast effects, heat effects, and the effects ofionising radiation. The proportions of these effects can vary depending on the size and nature of the bomb. For example, in the neutron bomb (the 'capitalist' bomb which kills people but docs not damage property) the blast and heat effects are greatly minimised while the radiation effect is greatly enhanced. But in the 'normal' nuclear explosion, some 50 per cent of the energy goes as shock waves or other blast dffects, 35 per cent as heat and 15 per cent as radiation. The range of these effects will be different if the bomb bursts in the air (blast and heat range will be greater) than if it bursts on

the ground (radioactive deaths, fall out etc, will be greater) or whether it explodes underground or underwater.

A sufficiently high overpressure (blast effect) on the human body will lead to ruputure and haemorrhages in the lungs, air embolism and rupture of the gut and ear drums. In addition blast effects on buildings etc, will indirectly create many more human casualties through flying projectiles and falling debris etc.

The fireball of a nuclear explosion (small one) will lock brighter than the sun at noon to anyone within a 50-mile radius of the explosion. To anyone looking at the fireball there is great likelihood of retinal burns leading to permanent blindness. The intense heat of such a fireball will raise flash burns of the skin. A partial thickness burn leads to blistering which can became infected. A full thickness burn is where the skin is completely destroyed. In both cases loss of crucial body fluids through the surface of the burn can lead to death. In addition, the explosion will create fires on the ground leading to flame burns which will cause lung damage through inhalation of smoke from a variety of burning materials especially plastic.

After a nuclear explosion comes the radioactive fallout as radioactive isotopes condense on debris and dust to produce the radioactive dustcloud. In the first 24 hours some 60 per cent of radioactive products fall to the ground. This is the early fallout. The 40 per cent which remains can take much longer to fall and can be dispersed over a wide area depending on weather, winds etc. This is the delayed fallout. This radiation causes damage to rapidly dividing cells such as those of bone marrow and the lining of the gastrointestinal tract. When the whole body is exposed one can get radiation sickness which is often fatal. One unit of dose i.e. energy absorbed per unit mass is called a rad and a dose of 450 rads will kill 50 per cent of young, fit adults. A dose of 150 rads will kill 50 per cent of elderly, already ill and children.

In the first form of radiation sickness/the bone-marrow form requires only an exposure of 150 rads. The first symptoms are lethargy and nausea, then nothing for 10 days. Towards the end of the second week there is maximum depression of the white blood cells and plateles which reduces the blood's capacity to clot and stop bleeding or protect against infection. Spontaneous haemorrhages often develop.
By fourth week many of the victims will die.

If the radiation exposure is high enough then there will be gastrointestinal damage where the cells of the small intestine are damaged. This leads to massive diarrhoea with loss of body fluids, to greater risk of getting septicaemia from bacteria emerging through the damaged lining. If exposure is higher still, then the central nervous system of the body is damaged leading to convulsions, coma and death in a few hours, If the victim survives, there will be gradual loss of mental and physical faculties which then results in death in a few days.

Where radiation sickness does not lead to death, it can destroy or damage fetuses in pregnant women. Brain damage was found in many children whose mothers were less then 15 weeks pregnant in Japan when the bombs fell. Small skulls (microcephaly) occured in 44 per cent of surviving children and 16 per cent were severely mentally retarded. The pregnancy of stillbirths and post-natal infant deathe rose dramatically.

The longer term effects of radiation through delayed fallout affect those not directly affected by the explosion. In these cases, radioactive isotopes are ingested through contaminated foodstuffs and fluids, by inhalation and occasionally through the skin. Radiation-induced cancers apart from leukaemia (which ocurs more quickly) can emerge after a latent period of 20-25 years. Genetic abnormalities and defects can take a number of generations before emerging since gene nutations are recessive.

Even a single bomb of the kind used on Hiroshima and Nagasaki would completely overwhelm medical resources. Quite apart from the psychological damage or the direct/indirect effects of the explosion, there would be a great deterioration in public health standard with sanitation facilities wrecked and incapable of coping with sewage clearance, providing clean drinking water and so on. Thus diseases like dysentry, infectious hepatitis and salmonellosis would be promoted. There would be diseases of overcrowding, meningococcal meningitis, diptheria and tuberculosis, diseases associated with dirt and vermin such as typhus and in Indian conditions, even plague. Common infections like pneumonia and septicaemia would become killers.

All this would be the *effect* of a few explosions. The effect of a nuclear war is simply unimaginable. The indirect effects would be far greater then the direct effects and impossible to calculate. As far as the environmental damage e.g to the earth's ozone layer, leading to worldwide and devastating ecological damage e.g. freezing of the temperate regions, submergence of large land masses under water, destruction of a large part of the world's agriculture, excessive ultraviolet radiation as atmospheric protection is eliminated—these arc all part of what is now called the "nuclear winter" scenario which could become a reality even if there was a "limited' or "small" nuclear war in a remote part of the world.

In sum for *purely* medical reasons *alone*, nuclear war must never be allowed to occur. No government should contemplate it and it should never be allowed to happen no matter what the circumstances.

Why Nuclear Arsenals ?

Why then do countries go in for building nuclear arsenals ? Why then the insane nuclear arms race between the superpowers ? Why then the attraction that going nuclear has for bomb lobbies in countries like India and Pakistan, which have nuclear weapons capability but have not as yet crossed the nuclear rubicon of openly deloying a nuclear weapons system?

Nuclear war is mind-boggling but precisely because it throws into the dustbin older prceon-eeived notions of war and its possible purposes, so many governments revert back to older forms of thinking in order to cope with the mind-boggling character of nuclear weapons. That is to say, these governments or these nuclear politicians or nuclear strategic experts try to treat nuclear weapons in much the same way as they try to treat and cope with conventional weapons—they try to make nuclear weapons into *viable instruments of a countrys foreign policy*. Since the uncontrollable dimension of nuclear weapons means that the use of nuclear weapons for political purposes is not viable (what possible political purpose can be justified by the use of such weapons?) what has become viable is not the use out the threat of its use. This is what is called deterrence. Having nuclear weapons becomes a way of assuring nuclear peace. Despite the universal character of nuclear weapons—its universal effects and the universal **honor at its use—this way of assuring nuclear peace is not the least universal in character or orientation but is strongly nationalist. Deterrence becomes a way in which a nation prevents nuclear war breaking out between itself and another nation having nuclear weapons by *intimidating* it. Thus the foundation of nuclear peace is nationalist intimidation and distrust.**

The great importance given to deterrence is ultimately a reflection of the bankruptly of those who have power in our societies. Nuclear weapons, as Einstein pointed out, should and must lead to a new way of thinking among human kind. Instead, very little has changed in the thinking of power elites. The best way to have nuclear peace say our tough-minded "realists" is to prepare for a nuclear war. What is more, if deterrence is to be credible, the possibility of a nuclear war at least a retaliation of nuclear attack must also be real. Thus, when governments say they do not believe that there can be any circumstances which justify the launching a nuclear weapons, thay are either wilfully lying or caught in an insoluble contradiction. If nuclear deterrence for a country's government is to be meaninful and credible, its willingness to launch nuclear weapons must be real in certain circumstances.

Deterrence, then, is a justification for the proliferation of nuclear weapons. There is both horizontal proliferation (more and more countries becoming nuclear weapons powers) and vertical proliferation (the superpower arms race and the other weapons powers adding to their nuclear arsenals). Both kinds of proliferation must be curbed. Such has been the insane logic of deterrence that both superpowers in the name of "national security" and "deterring the enemy" have embarked upon such a fast moving escalator of arms development and deployment, that both of them have enoromous "overkill" capacities. The end result of this search for nuclear security "has been ever greater insecurity vis a vis each other, and for the world". This is the historical balance sheet of all these years of nuclearly arming in order to keep the nuclear peace.

Finally, with the coming of Gorbachev in the USSR, there seems to be a chance (after three and a half decades of complete barrenness) of the possibility of the superpowers agreeing to a partial and limited disarmament in Europe.

redoubled their efforts to prevent any further proliferation. That left clandestine development as the only way out for nuclear ambitious countries.

The ambitions of such countries are difficult to check despite the best efforts. The first attempt came in the form of the Nuclear Nonproliferation Treaty; non-nuclear countries were induced to join it through a mixture of inducements and threats. But several refused to sign the Treaty giving highminded reasons. This was followed by the imposition of International Atomic Energy Authority (IAEA) safeguards on countries which wanted to build nuclear power stations. This regime was further reinforced by a group of 12 . countries coming together (informally called the "Club of London") which prevents the sale of nuclear materials outside the IAEA safeguards regime. All such efforts have registered only a limited success.

The most difficult problem about preventing proliferation is that the technologies for nuclear power generation and for producing weapon-grade fissile material are almost identical. While nuclear weapons have generally evoked feelings of horror, the generation of electric power based on the heat generated by a nuclear reactor has been largely accepted as benign and desirable. In countries such as India where the potential for developing coal or oil based thermal power or even hydro-electric power is limited, nuclear power generation is considered by some as the only way out if the growing energy needs of the country are to be met.

In recent years, nuclear power generation has been subjected to a great deal of criticism. The per kilowatt hour capital costs of nuclear plants are escalating rapidly. Safety has always been a problem but since the Three Mile Island near-disaster and the Chernobyl actual disaster, public anxiety about nuclear power plants has grown tremendously. The storage and disposal of nuclear wastes from the plants is **becoming a pressing problem as nuclear power stations grow in number and run for longer periods. Above all, some plants are now approaching the end of their useful life and the problem of decommissioning them have yet to be solved; even after 'entombment", they may have to be guarded for the next 2000-3000 years ! For all these reasons, ambitious plans for nuclear power generation are being cut down drastically in the industrialised countries. In 1974, the plans envisaged the production of 4.45 million megawatts of nuclear power generation by the year 2000. But now the projection has been cut down to 0.4 million megawatts or less than *10%* of the original target. Some countries are cancelling all the new plants on order.**

But the turning of the nuclear energy tide is taking place only in the highly industrialized countries. In the Third World, the expansion plans remain unaltered. In India, for example, the Atomic Energy Department is determined to go ahead with its plans despite horrendous cost-escalations, very serious time-lags, enhanced doubts about safety and the mounting problems of nuclear waste management.

If power generation were the sole objective, it can be achieved relatively quickly and efficiently by building the plants with foreign technology under IAEA safeguards.. This the Government of India has ruled out for future plants. The high-minded principle behind this is self-reliance and rejection of discriminatory teatment. These are laudable principles but they are evidently not applied to other sensitive areas. For instance, the high technology weapon systems in the armed forces are almost wholly imported. High-speed computers are imported despite discriminatory conditions.

If power generation is the only aim, why the tremendous secrecy surrounding the operations of the nuclear plants In fact, except for the locations of the plants and their generating capacities, no other important detail is made known. The size of the uranium stockpile, the

any such uncertain process. To establish a "credible deterrent" against China, India would have to embark on a crash programme of nuclear weapons development to make up the 15/20 year technological and deployment gap between the two countries as quickly as possible. Success in such an endeavour is by no means assured. But what can be assured is that such Indian 'efforts would greatly perturb China, and make it more willing to consider nuclear action or the threat of it against India. Such a move would also lead Pakistan to try and nuclearly "match" India and thus enhance the momentum of a regional arms race. There would be greater interaction distrust and hostility and above all, greater nuclear insecurity for the countries in the region—more and more insecurity in the name of the search for security. Nuclear security has to be a *common security* based on the virtues and strengths of disarmament not armament. It is the search for ways to disarm that hold the promise of a safer world not the search for how to use nuclear weapons **in the service of national real politic. The greatest tragedy of the nuclear era is the contradiction between the regionalisation/internationalisation of effects and dangers of nuclear war and nuclear arms races and the nationalised nuclear mind-set of those who are in a position to take crucial decisions concerning nuclear war and the arms races.**

While local and regional peace movements can play a vital role in promoting the *process of disarmament and sustaining its momentum, a world completely* and *permanently* safe from the Fear of nuclear weapons cannot be created by movements against nuclear weapons alone. Such a world requires transcending nationalism and national elites in the name of the universal interests of human kind. In short the struggle to create a truly and permanently nuclear free world is an intrinsic part of the struggle for socialism. Without a nuclear free world there will be no socialism. Without socialism there will be no nuclear free world!

***Courtsey : Achin Vanaik, Radical Journal of Health Vol/I No.* 4 *March* '87**

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ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Vol 2 No 2& 3 **October & Dece' 88**

WINDS OF CHANGE ?

Sometime in the beginning of this century, Gopal Krishna Gokhale remarked, "What Bengal thinks today, rest of India thinks tomorrow." Times Change. Today we live in the global village. What the Russian leadership thinks in the morning is well on its way to becoming the official Indian dogma before noon. Today's key word : GLASNQST.

Thus, after four decades of close-door operation, of being answerable only to the Prime minister, even the Department of Atomic Energy (DAE) has felt the need to justify its activities to the general public. As is well known, leopards do not change their spots. Neither do nucleocrats. Their prefered mode of educating the public has been to organise a series of lavishly funded seminars entitled "Atoms for Peace, Power and Prosperity." In these tamashas more than half the time is spent on enunciating the various uses of radioisotopes in nuclear medicine, agriculture, pharmaceuticals and the like. Not a word is said about the fact that all the radioisotopes used for these many purposes, come from the research reactors in Trombay and have nothing to do with the real reason behind these public relation exercises - the need to 'sell' the vastly expanded programme of power generation.

The "National Workshop on Nuclear Power with Special Reference to Kalga" held in Bangalore on December 10 and 11, was in stark contrast to these stage managed exercises. Organised by the Karnataka state government, it allowed for almost equal time between the antagonists and the protagonists of nuclear power. The workshop - the first of Its kind to do so - heralded the coming of age of the antinuclear movement in India. It showed rather Impressively, that even on narrow technical grounds, the antinuclear spokespersons well able to hold their own against the best 0 that the nuclear establishment can offer.

The major demand voiced at Bangalore was for free and unrestricted access to information. To a very limited extent, this demand was conceded. The Indian atomic anergy chief, Dr. M. R. Srinivasan agreed to make available reports on some nuclear establishments. This piecemeal approach is not enough. What we need and need right now is free and easy access to all Information. The 1962 Atomic Energy Act is a disgrace. No 'peaceful' programme need hide behind its cloak. For Glasnost to be more than a mere buzzword, sections 3c, 7 and 18 of this infamous act need to be scrapped forthwith.

AN APOLOGY

This issue of Anumukti Is appearing after an inexcusably long delay. Circumstances conspired to play a cruel Joke. There were deaths in the family, pressure of other work like the National Workshop *of* Kaiga and finally we had to shift our residence from Varanasi to Vedchhl. We deeply regret the very late publication of this double issue. Readers will hopefully also excuse the very dated appearance of some of the articles.

DISASTROUS DRILL

If the way things went at Tarapur during the disaster management exercise of the Tarapur Atomic Power Station (TAPS) on October 8 are any indication, then the residents of the surrounding village did a wise thing by fleeing. It is another matter that the Department of Atomic Energy (DAE) ex udes confidence on the infallibility of the TAPS reactor.

The whole exercise has brought to light that in case and DAE officials do not fail to stress that there won't be a "in case'!— of a radiation leak at TAPS, only providence can save the farmers and fisherman of the Palghar taluka of Thane district, 120 km away from Bombay.

However, the blame for the failure of the exercise has to be shared by the DAE, the district administration and the state government. Also the various agencies under them proved how incapable they would be In case of a real disaster.

The seriousness of the whole exercise was ignored and it was with an air of lightheartedness that the entire drill was conducted. So much so that an Atomic Energy Regulation Board (AERB) observer, who was on site along with scores of other observers, remarked, "Saturday's TAPS exercise was a sort of a mela."

A colorful tent, tea, cool drinks and a lunch session was spread out for officials of various organisations, local and an overdose of the local press corps, along with a few from Bombay gathered at the site. Absolute chaos and confusion prevailed.

The AERB official further pointed out that, according to regulations, the first man to be in charge of the situation once a site emergency is declared should be the TAPS superintendent. And the man to take Over from him the moment an off-site emergency Is declared should be the Collector of Thane district. However, while it was required of TAPS superintendent, K. Nanjudeswaran, to sit In the emergency control, room (ECR) set up at the Environmental Survey Laboratory, 14 km away from TAPS, till the arrival of the Collector he was out for most of the time in the mela, the AERB observer alleged.

Thane Collector G. B. Pingulkar was informed of the disaster at 8.15 pm, when the off-site emergency was declared. He reached the ECR at 10.50 am. This considering that it was an emergency. Pingulkar seemed to be going about the whole thing as if he was attending just another function where he was asked to perform the role of the chief guest.

Apart from the essential presence of these officials, the participation of the locals during the drill was also lacking. The panicky villagers, in the midst of the melee, had "evacuated" themselves.

There were many reasons for the panic, the main being disinformation. It was quite important that the message of the drill and its necessity be brought home to the common man. This message percolated down: but in an unexpected fashion.

The Collector claimed to have met about 500 teachers from the five villages, specially chosen for the exercises, and explained to them that there was going to be a drill. After that the teachers were supposed to have Informed the students who on their part, were to inform their parents. But the whole procedure failed.

The TAPS officials themselves were unsure about the distribution of an emergency information pamphlet which seemed to have caused more fear among some villagers who laid their hands on It. While some TAPS officials said that the pamphlets - in English and Hindi - were not meant to reach down to every villager but only upto the sarpanch level who in turn would explain It to the villagers'xerox copies were available with some villagers who could not understand it.

Another slip-up on part of the officials with regard to the pamphlet distribution was the illustration of an owl on the pamphlet with the heading "Words to the wise: Be prepared." Among the villagers, an owl is regarded as an omen of calamity.

The exodus started on September 5, three days before the drill. The first to leave were the comparatively affluent people of the villagers, and the poor followed them.

On September 7 morning, TAPS officials visited the villages. A village elder of Unbhat claimed that one official had stated : "We will release

some gas. for about 10 minutes, but nothing will happen."

On September 6 and 7, police vans mounted with public address system went round the villages announcing that there was nothing to worry and "Strict action" would be taken against rumour mongers.

But by now the people became more suspicious and panic had set in strong.

More rumours made their way into the villages. One was that there would be a Bhopal type disaster. The villagers also had Chernobyl in mind, a disaster they had come to know through television.

The local press corps also added fuel to the fire and disinformation, such as five people killed after falling out of overcrowded trains, and 95,000 tickets sold at Boisar railway station, were also reported. Local villagers also blamed some of the Palghat fortnightlies for creating panic.

Inspite of the warning, there were a few who stayed back to "guard their houses". A woman said, "One day we all have to die. I want to die here."

Since then, people have started returning to their houses. They are cursing the government, TAPS and all other connected with the drill. The attitude prevailing in the villagers is that the next time there is a drill, they wont run away.

Courtesy : Shrikant Shenoy, The Indian Post I7/1088

RUN, RABBITS, RUN

On October 8, 1988 the country's nuclear authorities organised an emergency drill at the Tarapur Atomic Power Station (TAPS). The evacuation drill was designed to train the population in the villages in the vicinity of the reactor on how they should respond In the case of a nuclear accident.

The experiment failed. In advance, Much before it was even tried.

As The Indian Post reported in its edition of October 9, "over 80,000 people from several villages around the TAPS deserted their homes and fled the area after **a** drill scheduled for today gave rise to rumours about an Impending radiation leak."

All Indian nuclear reactors are anyway candidates for "impending radiation leaks." So when "concrete" rumours of such a leak surfaced (no matter that this was actually a "hypothetical" leak), nobody wanted to take a risk. Certainly not with the kind of nuclear experts we have in service.

Time **and again** In the twentieth century, the public (whether literate or Illiterate) has demonstrated, that the best thing to do in circumstances where hi-tech hazards are Involved, Is not to waste time listening to reassurance from experts, but to flee like the rabbits in the Adams **novel, *Watership Down.***

In the case of TAPS, more than 60 percent of the villagers turned out to be unbelievers in the assurances deployed by Indian nuclear experts. Bus stations and railway platforms were packed with people getting out of the area. Schools and shops were shut, streets deserted.

India looked on at Bharat in chagrin, and fumed.

They shouldn't have been that surprised. Aren't we soon going to commemorate 4 years of the Bhopal gas tragedy, which alas we have almost forgotten as an event. But who will forget "Operation Faith" which turned out tobe another exercise in faithlessness ?

Operation Faith was the slogan given to the official effort to get rid of the remaining MIC in the storage tanks of the Union Carbide plant The man who coined the phrase " Operation Faith" was none other than Chief Minister of MP, Arjun Singh, whose immense faith in Union Carbide had earlier got him more than Rs. 2 lakh from the company for children's trust controlled by his family members In his hometown. But this kind of faith rarely moves mountains. The public in the days prior to "Operation Faith" did the best thing It could : it bolted. Shortly thereafter, even the copywriters of the operation lost faith : they hastened to bring in buses from the mofussil areas to transport those who wanted to get out of the old city.

At the Union Carbide plant, the men we were supposed to have faith in were actually only pretending to run the show. Dr. Varadrajan and Co were basking in the media headlines, announcing daily decreases in the storage levels of the stored MIC. But two things were happening which everyone knew.

First, despite the government decision to shut down the factory permanently, the company was being permitted to convert the MIC into sevin, which the company would still dispose in the market.

Two, the scientists were not really in charge. If they had been, the entire city would have fled. Imagine untrained persons operating such a complicated (and run-down) plant. Union Carbide people operated the plant, as they had always done. But it was put across as an effort at "detoxification". What a nice label for what was actually nothing more than the old process of sevin manufacture.

So why should the public have faith in liars, politicians and crooks ? In those who practice and participate in deceit ? Arjun Singh said that to allay fears he would himself be within the factory during the "detoxification" process. Ordinary villagers murmured that he would flee by helicopter the first sign of trouble and the scientists with him, leaving them to their helpless fate.

Perhaps, one is making too much of all this. This Is India, and we Indians tend to over react. Is this true ? Take the Three Mile Island disaster. It wasn't really very much different there either.

At the Three Mile Island atomic plant in Harrisburg. in March 1979, a pump driving water to a steam generator packed up, setting in rapid motion a bewildering sequence of events that ended In a partial meltdown of the core, and the creation of massive bubble of hydrogen within the reactor (1000 cubic **feet In size).**

Had the bubble exploded or expanded further, a full meltdown of the core would have been inevitable. The scientists were unable to do anything about the bubble. Eventually, after a number of terrifying days the bubble reduced in size of its own accord.

During the crisis, the Harrisburg public was given the option of staying on or moving out at the utility's expense. I don't know much of the education levels of the townspeople of Harrisburg, but I presume these are at least a little higher than those of the villagers of Tarapur or Bhopal. The US Is after all an advanced country. So how did the Harrisburg townspeople react ?

As at Bhopal during Operation Faith, people in Harrisburg preferred to run rather than stay. Nobody had faith either in the capacity of the men to control their machines or in the assurances of the experts that nothing would happen.

Neither at Chernobyl, or at the Sandoz chemical factory in Basel (Switzerland) or Bhopal plants or at Harrisburg, did the experts know what the hell was happening. The malfunctions commenced, events moved totally out of control and relief came only after the process had run out of steam on its own. At Bhopal, the MIC exhausted itself, at Sandoz on the Rhine a similar pattern was repeated. Similarly at Chernobyl.

There are two major reasons why experts have begun to stink. The public now acknowledges that experts generally have tunnel vision and stunted minds. Earlier, the expert could pretend that his expertise in one field automatically equipped him to talk authoritatively on any subject. Now that seems a distinct disadvantage. If one Is still forced to rely on expert assurances for survival, one also opts wisely at the same time for insurance cover.

But the other reason is more significant. And that is that experts are as shifty as weathercocks. The Government of India for instance knows that the state of scientific knowledge is such that one set of experts can always be relied upon to underwrite whatever decision it wants to take for extraneous, undisclosed reasons. Experts today are not merely flexible and pliable, they are In addition expert in lying. In order to protect their salaries and privileges, they may even sell the nation down the nearest sewer.

Examples there are galore. Take the experts from the dairy sector for instance. Once we required experts to say that there was nothing wrong in getting free imports of milk powder from the EEC for Operation Rood. It would have no economic consequence, they said. Now that we are purchasing milk powder from the EEC market, and are hooked onto such commercial purchases for good, those experts have done the vanishing trick.

This year we required experts to state that there was nothing wrong in using radioactivtly contaminated butter given free by the EEC for Operation Flood. We got them. They even got together for a national seminar on "Public Health Aspects of Radioactivity In Dairy Products- in New Delhi, and proceeded to give us sermons on how the milk was safe. Nobody would enlighten us on how we had landed ourselves in a position In which we were being forced to drink radioactive milk even while every other Third World country from the Philippines to Bangladesh had refused. Not for nothing that many people preffered to go without milk altogether.

Finally, consider the case of the Silicon con. Experts after experts said we needed foreign collaboration in silicon technology because the country's demand for the material (for use in photovoltalcs and electronics) would be 200 tonnes by 1990. So we went In for collaboration with Hemlock, USA. Then we cancelled that, paid Hemlock millions of dollars as punishment, and decided on the advice of experts to get Indian made silicon. Then the same group of experts certified that all that India actually needed now was only 40 tonnes of silicon. Why ? Because this was all the Indian sector was capable of. In the process, the country lost its option to learn to make electronics grade polysilicon. When the government wanted experts to state that Indian technology was adequate, it got a committee to do that too.

So the villagers living In the shadow of TAPS were acting purely In their self-interest, and quite rationally too, when they heard that our experts were going to simulate a nuclear emergency. Since modern science is bound to explode and erupt, time and again, for the most humdrum reasons such as falling motors and dumbfounded computers in socialist and capitalist environment, it is best to take all precautions. After all, as we found at Bhopal and Chernobyl, those who design these monsters, our scientific and technological experts of the 20th century, have only one course of action to recommend when such disasters commence: a wholesale reliance on physical flight. Run, rabbits run!

Courtesy: Claude Alvares

THE MAZE OF NUCLEAR MYTHS

The Indian nuclear programme began early. At the time when Hiroshima and Nagasaki were lust two obscure Japanese towns, Bhabha had dreamt the nuclear dream. Nuclear energy was to be the vehicle to launch an Independent and self reliant India Into the the modern age.

Four decades on, the time has come to take a second look. Nuclear enterprise has given rise to a very rich mythology. Nuclear arguments, which have **a** habit of shifting ground, often leave the uninitiated lost in the maze of myths. Let us examine some of the myths one by one.

"Pinnacle of Scientific Achievement"

Mastery over nuclear power is the key to scientific sophistication." The future belongs to science and to those who make friends with science."(Jawahar Lal Nehru) Nuclear technology may have problems - all technology does. Mankind has met all previous challenges to existence. So why doubt now?

The terrible and awful demonstration of the power of the atom at Hiroshima and elsewhere has implanted this myth very deeply Into all of us. But the very relentlessness of the scientific advance has left it somewhat in tatters. Specially since the late seventies, high energy prices have encouraged dramatic improvements In hundreds of energy technologies. Many technologically advanced nations, which had trudged much further down the nuclear road than India are now making vigourous efforts to extricate themselves. Thus, going nuclear In a big way today, Is not a sign of technical sophistication but rather its very opposite.

The threat posed by nuclear technology to human survival is far greater than that posed by any previous technology. Nuclear power uniquely combines several different threats. The process of nuclear fission itself produces some of the most toxic substances known. Miniscule quantities of these have been shown to cause

cancers and genetic abnormalities. All the processes connected with nuclear technology - the entire nuclear fuel cycle - produce huge (order of tonnes) amounts of these toxins. There Is no solution to the problem of disposal of nuclear waste. Thus the threat is not only from (the a catastrophic accident due to human fallibility ala Chernobyl. There Is the possibility of deliberate sabotage of a nuclear facility by a deranged operator. (This actually happened in 1961 In U.S.A.) or, like Kyshtym in the Soviet Urals (1957), there is the chance of an explosion in a nuclear waste dump which can devastate hundreds of square miles. On the top of all this is the perpetual threat of nuclear war between nations and nuclear terrorism by subnatlonal groups. A technology that can end the world both by a bang and a whimper.

Breaking the vicious Circle of Poverty

Development - Growth - Ever increasing energy use

Energy - Electricity - Bulk generation + Grid distribution

The only sources that need to be considered for bulk generation are coal, hydro, oil and nuclear. The sources of all except nuclear are limited and geographically maldistributed. Hence, if the hungry millions are ever to be fed, nuclear energy is a must. Q.E.D.

All the steps in this argument are questionable and some are patently false. By now, it is well documented that the fruits of development seldom reach the poor while the thorns Invariably do.

Domestic fuel is the biggest contributor to the real energy crisis facing the country today. This crisis urgently needs a solution, it is the cause both of deforestation as well as decline in soil fertility through the burning of cow dung. Producing more and more electricity is no solution to this problem at all. Energy-wise, electricity is the most Inefficient way of cooking food. Nuclear power, which can deliver energy only in the form of electricity is thus no answer to the real needs of the rural poor. In fact, because of the massive diversion of resources it entails and the very long construction times of nuclear infrastructure, nuclear energy is one of the causes of the present energy crisis.

Nuclear resources are far more scarce and limited than other resources. While the coal deposits within the country are sufficient to last hundreds of years at present rates of consumption, the uranium deposits would be hard put to last another fifty.

"Only Source for the Future"

"True, our uranium resources are limited and of poor quality. But in a programme based on the fast breeder reactors, they along with our very vast thorium deposits can sustain a very enhanced (350.000 megawatts as compared to the present 1,000 megawatts) power generation capacity. We already have a prototype fast breeder reactor in development at Kalpakkam."

There is many a slip between the prototype and the lip. The trouble is that nobody has as yet run a commercial scale fast breeder reactor successfully. The French programme, which is the most advanced, is in doldrums. The environmental and safety Implications of the breeders are many times more horrendous than the already horrible enough problems of the conventional reactors. The electricity they might produce is also likely to be many times more expensive.

Besides, the past performance of India's nuclear industry gives no cause for optimism regarding its abilities to deliver on its promises. in 1962 for instance, Bhabha had projected a nuclear generation capacity between twenty and twenty five thousand megawatts, for the year 1987. The actual Installation of Just over a thousand megawatts Is an indication of the magnitude of failure on the performance front. Teething troubles' are the perpetual excuse for poor performance. Fast breeders which have yet to be properly born, are certain to have their share of 'teething troubles'. Hence, It is a sure bet that this mantra will often be invoked by the next generation of nuclear technocrats.

" Indian Scientists are Second to None "

" We have done it all by ourselves. There have been problems and delays, but the lessons learnt have been invaluable in our march to self sufficiency and mastering of nuclear technology. it is an achievement the nation can justly be proud of."

As a proud member of the Indian scientific community myself, I know, that in fact we are second to none. But do the big shots of the nuclear establishment know the same? With the fast approaching advent of the 21st century, they have developed cold feet. Otherwise, they would not have acquiesced to the insult delivered to the

self esteem of the entire Indian nuclear community. By signing the agreement for the import of two Russian built reactors and by negotiating with the French for the Import of two of their reactors, the political leadership has expressed its no-confidence in the abilities of Indian nuclear technologists. It is a mater of shame that this humiliation has invoked no public cry of protest and the nuclear establishment is willing to fritter away the hard won benefits of self reliance so casually.

" **It Can't Happen Here** "

" There is no free lunch. People die in coal mines. Large dams can suddenly fall killing thousands. Think of Bhopal. The chances of a large nuclear disaster are mlnlscule. There are now more than 400 reactors operating safely all over the world. Only 32 people died at Chernobyl. And In any case, Chernobyl cannot happen here since our technology i s different, we have double containment and we use graduate engineers instead of high school pass people as operators."

The overwhelming majority of the victims of radiation disasters die unknown, isolated from each other in both space and time. This makes it possible for nuclear propagandists to continue this barrage of bilge. Independent scientists have estimated Chernobyl's human toll at around a million cancers, half of them fatal and more than half of them outside the Soviet Union The financial toll of the disaster, which is less subject to dispute, stands at an astronomical $14 billion. It is an awesome warning that even a single major nuclear accident could completely ruin the entire Indian economy.

Accidents have been taking place more frequently than the schedule chalked out for them by nuclear risk analysts. The fact that our reactors are of a different design, does not make them fool-proof. A study conducted in the wake of Chernobyl, concluded that reactor designs in operation all over the world had shortcomings. Given the 'right' errors and even graduate engineers have been known to make errors - these design shortcomings could lead to disasters, double containments or no double containments.

Too Cheap to Meter "

The economics of nuclear power is a subject which closely resembles magic. Research costs, insurance costs and all the social costs vanish without a trace. Nobody yet knows what the decommisionisng costs are even likely to be. The costs of waste storage for thousands of years are donated for kind rememberance to our children. And the costs that are Included in the calculations have a surreal quality. The Comptroller & Auditor General's office (CAG) recently commented on a strange practice It observed In the heavy water plant at Tutlcorln. The cost of the heavy water produced calculated by the Department of Atomic Energy turned out to be Rs. 4120 per kg. as compared to Rs. 13800 per kg. estimated by the CAG. Investigations revealed that achievable Instead of actual production figures were used in cost computations. After all this, one gets a statement like, " Our calculations show that while the nuclear power plant at Kalpakkam produces electricity at the rate of 48 paise per kilowatt hour the thermal power plant at Tuticorla produces electricity at more than 60 palse per Kilowatt-hour." Applause.

In countries which allow a freer flow of market forces, economic compulsions have already spelt the doom of nuclear industry.

"Well Within Internationally Accepted Safe Limits."

" The radiation releases from our nuclear establishments are well within the Internationally accepted safe limits and there Is no danger to our workers or to the people in our neighbourhood. Just look at the greenery around our establishments. We have not only maintained the environment but significantly improved It."

No other group of internationally renowned experts have fallen flat on their collective faces as often as those belonging to the radiation community. There was a time when the ICRP (International Committee for Radiological Protection) believed that there was a 'safe' threshold level of radiation exposure, below which the radiation was harmless or may be even beneficial. In the 1960s It was forced to admit that there is no safe threshold - the risk of radiation simply increases with the dose received. Thus the so-called 'safe' limits are In actual fact 'acceptable risk' limits. However, as the ICRP already concedes, the limits presently set are far too high. The latest revaluation of the Hiroshima data left the ICRP on other choice. They have however, as usual, delayed action on setting a newer, lower limit by two years. Even Britain, a country not particularly distinguished for the zeal of its nuclear officials in protecting

public health, has already lowered its radiation dose limits.

The Myth of the 'Peaceful Atom'

This is the one myth which everyone knows to be a myth. Hence the great demand that it be publically rejected and the country embark upon a programme of building a nuclear arsenal. In all this jingoistic talk one point gets invariably lost. We have already exercised the nuclear option. The nuclear facilities have already been built. They await the enemy's pleasure. Israel, by demolishing the nearly completed Osirak reactor in Iraq by conventional bombing, has demonstrated to the world, the vulnerability of reactor containments to high penetration bombs. Nuclear facilities, seen **in this** light, **are** more In the **nature of** massive nuclear time **bombs** or ammunition dumps **awaiting** detonation.

"I, a mere Individual, can do nothing"

The most immobilizing myth of all. This monstrous programme continues because you and I have done nothing to stop it. Edmund Burke put it well long ago: " All that is necessary for the triumph of evil is that good men do nothing."

S.N. Gadekar

BENEATH THE VENEER OF PROGRESS : A SICK INDUSTRY

At 1.00 on the morning of May 26, 1988 the Long Island Lighting Company and the State of New York reached an extraordinary settlement. The utility agreed to sell Its completed but never operated nuclear plant at Shoreham to the State for one dollar, while the State promised to permanently close the $ 5.30 billion facility and grant the utility rate increases intended to save it from bankruptcy.

To one not familiar with the current status of nuclear power, the Shoreham saga has an Alice In Wonderland quality. How. might one wonder, could nuclear planners have sited a plant in a densely populated part of Long Island, and then pushed the project forward despite overwhelming local opposition?

How could the original schedule of construction have been missed by more than a decade and the budget by more than $4 billion? How could a private company have tied its very survival to the completion of a single power plant whose cost exceeded the value of all Its other assests? And how could the Nuclear Regulatory Commision have allowed a utility to load radioactive fuel into plant unlikely to ever get a full operating license, an act that will add hundreds of millions of dollars to New York' s expense for decommissioning Shoreham?

The Shoreham case is extreme, but it Is symbolic of the problems currently facing unclear power. It Includes colossal mismanagement,cost overruns and fierce political battle's that pit citizens and local officials against government bureaucracies commited to expanding nuclear power.

Two years after the Chernobyl accident, the political and economic tide around the world is running strongly against nuclear power. Nuclear power has become expensive, its growth has been mismanaged, and an increasing number of citizens are rejecting It. The daunting problems of nuclear waste disposal and nuclear materials proliferation grow ever more Indomitable as governments fall to come up with solutions and the materials themselves accumulate.

Despite the lack of such solutions, some officials are now calling for a revival of nuclear power. The new Impetus: global warming and other environmental threats caused by the world's reliance on fossil fuels. The world's current energy trends are beginning to undermine the health of the environmental system crucial for humanity's survival

As governments and international agencies look for alternatives to oil and coal, nuclear power Is once again presented as a candidate. Societies are now in danger of banking on a new generation of nuclear reactors without fully understanding the enormity of problems that ruined the last generation.

A Decade of Setbacks

When disaster struck the Three Mile Island nuclear plant in March of 1979, the global nuclear

industry was running at full throttle. New plants were being built at a record pace, governments were almost universally In favour of nuclear power, and public acceptance of these plans was unquestioned. Three Mile Island, however, was the first In what would be a series of setbacks for nuclear power. Now, almost ten years later, the nuclear programmes of nearly every country have been touched by the ripple of doubt set off by that accident and the one at Chernobyl.

At first glance, It would seem that nuclear power has continued to flourish in the past decade. Generating capacity for example, has risen fourfold to 290,000 megawatts. But beneath this veneer of progress is a sick Industry that is getting few new orders and In many countries Is clearly winding down.

In the United States, Three Mile Island was a pivotal event. As the pioneering nuclear nation, the U.S. had by far and away the world's most ambitious nuclear programme In 1979. Yet, not a single nuclear plant has been ordered In the United States since, and 108 have been canceled, Including all those ordered after 1974. The U.S. business magazine Forbes has called the failure of the U.S. power programme "the largest managerial disaster in U.S. business history," Involving perhaps $100 billion in wasted investments, cost overruns, and unnecessarily high electricity costs.

The U.S. nuclear construction Industry has for the most part disappeared, and the pipeline of new projects is nearly empty, sustained only by a handful of plants that are a decade behind schedule on average. It now appears that the nuclear share of U.S. electricity production will peak no later than 1992 - at something less than 20% and then begin a slow decline as older plants are retired.

It was economic more than political or technological failure that doomed nuclear power in the United States. As with the Shoreham plant, most U.S. nuclear facilities completed In the eighties are grossly uneconomical, providing power that is five times as costly as that from plants completed a decade ago.

Hundreds of changes introduced to make nuclear power safer have added billions of dollars to costs. The industry attempted to blame regulators for requiring expensive change, but it is clear in retrospect that the changes were needed to help avert accidents that would have caused the nuclear industry even greater damage.

Europe After Chernobyl

Advocates oi nuclear power often argue that the *VS.* nuclear programme Is beset by problems of little relevance to the rest of the world. The supposed strength of nuclear power throughout Europe and much of the rest of the world is often held out as evidence that If nuclear managers and regulators would simply clean up their acts, the problems would soon be resolved.

As attractive as this argument may seem, It is belled by the declining fortunes of nuclear power across a wide spectrum of countries - from Western democracies to the Soviet Union and the developing world. A process of gradual attrition during the eighties has mushroomed into a massive rejection of nuclear power since Chernobyl - more for political reasons than for technological or economic ones.

In Europe several countries have made formal commitments to shut down their nuclear programmes In the wake of Chernobyl. Months after the Soviet disaster, Austria abandoned its only nuclear plant, at Zwentendorf - a plant that like the one at Shoreham had never been operated. Greece decided at about the same time to scrap plans to build Its first nuclear plant.

After a protracted political debate that contributed to the collapse of two governments, Italian voters decided in March 1988 to block the expansion of the country's already stalled nuclear programme. Two months later, under Intense political pressure, the Italian government decided to stop work on the country's only remaining nuclear construction project, at Montalto dl Castro, leaving three completed reactors operating Intermittently. Though not quite officially dead, Italy's nuclear programme shows few remaining vital signs.

Early In 1988, the government of Belgium, which is already heavily nuclearized decided to indefinitely postpone expansion plans. The Netherlands, which has no large reactors, has also canceled Its plans.

Switzerland, which has not completed a nuclear plant since 1980, decided this year to

cancel 22 - year old plans to build the country's sixth nuclear facility at kalseraugst. Swiss voters will decide later this year whether to abandon the country's nuclear programme.

Scandinavia's nuclear programmes have also been moving In **reverse.** Finland, with a substancial nuclear capacity, Indefinitely postponed expansion **plans after** Chernobyl. Sweden decided In a **1978** referendum to phase out nuclear power by 2010, despite the fact that nuclear plants supply 40% of the country's electricity. The Chernobyl accident forced the government to firm up these plans by scheduling the shutdown of the first two plants in 1995 and 1996. Denmark and Norway, meanwhile, have reaffirmed their vows never to develop nuclear power.

Europe's second and third largest nuclear power programmes remain in a state of Umbo. Nuclear opposition has flourished in West Germany since Chernobyl, further weakening the already remote possibility of the country's building additional unclear plants. Several state governments and the major opposition party In the federal parliament **are** vehemently opposed to nuclear power.

In Great Britain, the Thatcher government got to work on a nuclear plant at Sizewell after It concluded an eight year debate in 1987. Should this plant be followed by Several more, Britain **will still be hard-pressed** to outpace the scheduled retirement of nuclear **plants** In the nineties.

France meanwhile remains Europe's pronuclear holdout. Four more plants were completed In 1987, leaving the country with a nuclear capacity second only to that of the United States. Nuclear power now supplies over 70% of the country's electricity.

But even France's nuclear programme Is plagued by a growing number of technical malfunctions. In the spring of 1988, one plant at Flamanville lost its cooling capacity twice, a plant at Nogent sur Seine released radioactive steam, and several other plants were closed due to radiation leaks. France has so far avoided a Three Mile Island or Chernobyl-style debackle, and It Is uncertain whether the pronuclear consensus would survive such an event.

The more obvious problem In France Is too much nuclear capacity. The country has been forced to sell electricity to neighbouring countries at bargain prices and to run its plants at reduced capacity. The gap will grow larger as another ten plants come on-line in the next few years. Frances nuclear expansion has been slowed to less than one plant per year, a level Intended Just to barely support the government owned nuclear manufacturing Industry.

The French state utility **has** built up an enormous debt of $39 billion, which continues to grow as high-cost nuclear electricity Is subsidized so as to encourage consumption and justify the Investment. Nuclear power has helped reduce the country's oil Import bill, but It has also tended to starve other parts of the French economy of Investment capital.

Second Thoughts in the **Soviet** Union

Prior to Chernobyl, the Soviet nuclear programme - third largest in the world - was generally thought to have avoided the morass of political problems that derailed programmes in the West. The Soviet government maintained a firm commitment to nuclear power In building an Industry that supplies \\% of the country's electricity.

Since Chernobyl, the Soviet nuclear consensus has broken down. Top Soviet officials regularly contradict each other as to the status of nuclear power and the capacity of the Soviet Industry to manage it. The cleanup at Chernobyl has not gone well, and the total cost of the accident is now calculated at $14 billion - nearly three times the original estimate.

Meanwhile, rumours of radiation related sickness continue to circulate In the Ukraine, and citizens report a general sense of tearfulness and unease two years after the accident. Public confidence has been further undermined by reports of subsequent mismanagement at the remaining Chernobyl reactors, breaches serious enough to require disciplinary action against key officials.

Such stories have fueled an outburst of antinuclear protest throughout the Soviet Union Indeed, Soviet press reports indicate that all of the country's operating nuclear plants face local opposition, as do most of those being built. Even

in the era of Glasnost, such protest betray a remarkable degree of dlsquite with government policy. Some local officials even used the occasion of the landmark Soviet Communist party conference in June to call for the abandonement of particular nuclear plants.

The most vociferous protests, not surprisingly, emanate from the Ukraine, where Chernobyl is located. Both the Ukrainian Writers' Union and the Ukrainian Academy of Sciences have drafted a "manifesto" condemning the policies of the Ministry of Atomic Energy. Antlnulcear petitions demanding a change of course have circulated at Moscow State University and the Crimean Agricultural Institute.

Soviet nuclear officials have stuck to their pre-Chernobyl plans, agreeing only to phase out production of reactor design used at Chernobyl. Nuclear capacity in the current five year plan is scheduled to advance by a substancial 40,000 MW towards the goal of supplying 21% of Soviet electricity by 1990. This target, will almost certainly, not be met. In the past year an obvious gap has opened between official plans and reality.

In May 1987, It was announced that the two additional units planned at Chernobyl would not be built. Then in November a high Soviet official conceded that citizen opposition had forced a halt to construction of two more nuclear plants, one near Odessa and the other near Minsk. Later that month the Ukrainian council of Ministers halted construction of a plant south of Kiev. In January 1988, the Krasnodar plant In the Caucasus was also stopped, reportedly dueto seismic dangers that had been neglected earlier.

It is impossible to read this litany of setbacks without suspecting that the Soviet nuclear programme is in the process of coming seriously unglued. The growing cost of safety measures in the aftermath of Chernobyl will likely cast further doubts on the efficacy of nuclear investment.

It is only a matter of time before the current, unrealistic five year plan for nuclear power Is revised downward. Portions of the Soviet scientific community now seriously question the nuclear programme, and an important faction of scientists and economic planners now favour an alternative approach to energy policy - In the direction of efficiency, renewable resources and decentralized power generation.

The Shifting **Case** for **Nuclear Power**

As nuclear power programmes continue to slip into oblivion the question remains whether countries can afford not to have nuclear power. Many key officials think not. Valert Legasov, who headed the Soviet commision that investigated Chernobyl accident, has stated that "the future of civilization is unthinkable without the peaceful use of atomic energy."

This line is nothing new from the pronuclear camp. Although they have remained stalwart in their conviction of the necessity for atomic power, many nuclear advocates have Justified It by repeatedly shifting among various arguments. In the sixties, nuclear power was pressed as an Inevitable next step in the technology of energy systems. Few problems were seen as beyond the reach of scientists, and it was assumed that nuclear power would be inexpensive If not actually "too cheap to meter."

In the seventies, nuclear power was seen as an essential alternative to dwindling oil supplies, not without its own problems, but essential to stave off economic collapse. Now, In the late eighties, with oil prices down and nuclear power programmes in disarray, nuclear advocates have become environmentalists, urgently arguing that only nuclear power can ease acid rain, global warming and other threats posed by heavy use of fossil fuels.

The "technological inevitablity" argument was first to go. Since the late seventies it has become clear that that evolution of an energy technology does not necessarily have to take a nuclear path. High energy prices have encouraged dramatic improvements In hundreds of energy technologies, ranging from more-efficient oil refineries to less-expensive solar power.

During the past fifteen years, for example Improved energy efficiency has saved far more oil than has nuclear power. Many countries now persue the long term development of hydroelectric and wind power, solar energy and biomass fuels as an alternative both to oil and nuclear power. Whatever the arguments for its development, nuclear power must now be fairly weighed against its alternatives.

Using nuclear power to fuel the economy on a large scale is possible only if it is affordable.

And the best evidence available indicates that investing in nuclear power has become a risky proposition, in the United States, where financial reporting requirements are the strictest, the latest generation of nuclear plants has proven to be decidedly uneconomical. These plants cost more than three times as much to build as equivalent fossil fuel plants, and significantly more than a number of renewable energy facilities, Including wind, geothermal and blomass-flred power plants. As other power generating technologies evolve, nuclear power's financial disadvantage only widens.

Operating costs - an area In which nuclear power has traditionally enjoyed an economic advantage - are also growing malignantly. The equipment must be repaired or replaced far more frequently than was supposed. Recent surveys in the United States indicate that real operating the average nuclear plant than it does to operate a coal plant-including the cost of coal. A study by the U.S. Department of Energy suggests that some plants have become so costly to operate that it may be more economical to retire them early than to continue operations. Even writing off the $5.3-billion Shoreham plant may in the end turn out to have been a **wise** business decision.

At the root of these enormous cost escalations is a technology whose complexity defies human management and leads to continuing, unpredictable changes In equipment and operating procedures. Even in countries, where regulatory pressures have not been **as** Intense or public opposition as vehement, cost overruns have become endemic.

When planning a nuclear plant today, It is impossible to know how much it will cost to build, how much It will cost to operate, how long it will last, or what it will cost to decommission. This is the kind of Investment that only a government or utility would make, and even they are now generally investing elsewhere.

As an alternative to oil, nuclear power's potential is also severely constrained. While nuclear power generation did substitute for oil-fired generation in Europe and Japan during the late seventies and early eighties, the power sector's use of oil is now extremely low, offering little potential for further displacement.

Throughout the world, the major claimants on the world oil supply are automobiles, trucks, buses and Industrial plants, Improved efficiency offers by far the most effective means of displacing oil in these areas.

False Hope for the World's Climate

The environmental argument for further nuclear **expansion is** at first glance more compelling **than the** other two. Continuing expansion of **fossil** fuel combustion is now causing ecological havoc around the world. Air quality in most of the world's cities continues to deteriorate, particularly in developing countries, and air pollution carried over long distances has damaged at least 22 percent of Europe's forests.

As serious as these problems are, the ultimate limit to future energy growth may lie with the earth's climate. Scientists now believe that the 5.4 billion tons of carbon being added to the earth's atmosphere each year from the combustion of fossil fuels is contributing to Ireversible climate change. Average global temperature have already increased by about 1 degree Fahrenheit during the past century, according to a U.S. government-sponsored study published in the spring of 1988.

Global warming has begun, according to the best available scientific evidence, and climate models suggest a 9-degree rise by the middle of the next century, a faster warming than the earth has ever experienced. This would be sufficient to upset weather patterns, damage agricultural output, raise sea levels and expose humanity to wrenching change. With population expanding rapidly and the world food system already stretched tight, societies would probably find it impossible to adapt to such sudden change.

New scientific evidence along with severe droughts and heat waves in several countries this summer have lent a new urgency to the problem of global warming. In this light, many policymakers around the world are reassessing nuclear power. An International conference of scientists and public officials, meeting in Toronto, has called for a worldwide effort to cut fossil fuel use by 20 percent by 2005. Nuclear power was one of the energy, sources the conferees suggested reevaluating for its potential to combat global warming.

Some argue that a few Cheraobyls would be a small price to pay head off global warming. Unfortunately, this Is the kind of thinking that has misled nuclear planners In the past. Nuclear power is beset by problems that go well beyond its propensity for occasional accidents. Technologically, economically and politically, nuclear power faces a series of obstacles that will prevent it from coming close to displacing enough fossil fuels to significantly delay global warming.

Analysts at the Rocky Mountain Institute, a nonprofit research organization In Colorado, have developed a nuclear scenario that reduces global warming by 20 to 30 percent by the middle of the next century through the substitution of nuclear plants for all coal-fired power plants. They found that this would require the completion of one nuclear plant every one to three days during the next 40 years. Many countries would be almost blanketed by nuclear plants, and the total cost would run to as much as $9 trillion.

A nuclear power program of this scale would require not just a reversal of a worldwide trend, but a program of nuclear construction that is ten times as large as any the world has seen. Such an effort Is unthinkable, both economically and politically. Indeed, a democratic government that tried it would most likely soon be voted out of office.

Most nuclear technologists agree that a new generation of "inherently safe" reactors will have to be developed before nuclear power expands, even modestly. If governments were to throw their support into research and development programs large enough to accomplish this, It would be after the turn of the century before the first of the commercial reactors could possibly by Installed

Were such a program carried out, it would contribute virtually nothing to the 2005 goal of the Toronto conference, and would contribute only a small part of what is needed by 2050. One problem is that power generation is only part of the reason for global warming, and displacing a substantial part of even this use of fossil fuels would require an Inpossibly large investment in nuclear power.

Toward a Viable Energy Strategy

As the world faces the problem of global warming, it is important to come to grips with the timing of the problem. The earth now appears to be warming at a rate of about 1 degree Fahrenheit per decade, and because of time lags in the process, we are already committed to a significant increase of 3 to 4 degrees. Therefore, immediate action is needed to head off a catastrophic warming during the next several decades.

Nuclear power is clearly Incapable of making a meaningful contribution during this period. The global climate would be undermined before an Improved technology could even be tested, a fact that many nuclear advocates seem to be unwilling to confront.

Improved energy efficiency, however.does have the potential to reduce the projected warming in 2050 by up to half. Such a scenario requires that energy efficiency be improved by 2 percent per year beginning immediately. The technologies needed to accomplish this are at hand, and they can be economically installed. However, policy reforms are needed If we are to continue the enormous efficiency improvements made during the past decade.

ln the long run, of course, societies will have to develop energy sources that replace the fossil fulse on which we rely so heavily. There are really only two alternatives: nuclear power or renewable energy sources such as solar, wind and blomass. Since the seventies, energy policymakers and analysts have been debating the question of which path to follow. The global warming problem adds new urgency to this debate but does not make the answers any easier to come by.

Renewable energy technologies have advanced rapidly during the past 15 years of research funding, and many are being used commercially on a fairly large scale. They have a long way to go before being ready to provide the predominant share of world energy, but it is quite possible that before Improved energy efficiency begins to reach technological limits in the middle of the next century, a diverse mixture of geothermal power, wind power, blomass and solar energy will have picked up the slack.

Nuclear advocates believe that a new generation of nuclear technologies will be ready (or mass deployment as well. This is certainly an arguable point. Technological evolution is notoriously difficult to predict. However, societies are likely to find that nuclear power continues to fall short of Its proponent's dreams and that It In the end faces technological, economic, and political limits that are far more intractable than those confronting renewables.

I Projection of Worldwide Nuclear Power Generating Capacity

1 Source and Year of Projection	* 1980	Projection For 1990	2000
	(thousand megawatts)		
International Atomic Energy Agency			
1972	315	1,300	3,500
1974	235	1,600	4.450
1976	225	1,150	2.300
1978	170	585	1.400
1980	137	458	910
1982	–	386	833
1984	·	382	605
1986	-	372	505
World Watch Institute			
1988		320	360

Source : International Atomic Energy, Agency, Annual Rreports *(Vienna 1972-80); IAEA.* Reference Data Series No. 1. *Vienna, September 1982, IAEA,* Nuclear Power: Status and Trends *(Vienna : 1984-86); World watch Institute.*

Nuclear power requires increasingly centralized energy systems and intense safety measures and security systems. Renewables are by nature diversified, decentralized, and based on relatively safe technologies. Although renewables will cost large sums to develop, they have the advantage of being more politically palatable according to public opinion polls.

Most major governments have managed to skirt this central question by funding development **of** both nuclear power and renewables. The broad trend has been away from nuclear power and toward renewables, though the latter still receive a smaller share of most budgets.

The question now is whether to continue the current approach or to attempt to accelerate the development of either nuclear or renewables. There is no simple answer to this question, but if the lessons of the past decade and a half mean anything for the future, attempts to resuscitate the nuclear option will yield political friction, economic waste and serious accidents, not a solution to the global warming problem.

Courtesy: Christopher Flavin : World Watch, July-August '88. Christopher Flavin is vice president for research at the WorldWatch Institute and author of the 1987 Worldwatch Paper "Reassessing Nuclear Power: The Fallout From Chernobty".

SOVIET REACTORS FOR INDIA

In anticipation of the flnallsation of the India-USSR inter-governmental agreement on the supply of two 1000 M We nuclear power units by USSR, India concluded recently an agreement with the IAEA for implementation of safeguards In respect of these nuclear power stations. According to Mr. K. R. Narayanan, the minister of state In the department of atomic energy, the safeguards agreement, signed on September 27, 1988, was broadly similar to those in respect of the Tarapur atomic power station and the Rajasthan atomic power station. According to the minister, the safeguards agreement Inter-alla provides for IAEA safeguards for all nuclear fuel used in the reactors supplied by the USSR. The reactors will be under IAEA safeguards till the IAEA, India and the USSR jointly determine that the reactor in question is no longer usable for nuclear activity relevant from the point of view safeguards. In addition, it provides that safeguards on spent fuel will terminate in case it is transferred to the Soviet Union.

Different Reply

A study of the agreement in question reveals that the reply given by the minister differs sharply from the provisions of the agreement. The safeguards applied by IAEA are far more stringent than any accepted by India so far. They require safeguards on:

i) The reactor facilities supplied by the Soviet Union to India under the agreement, *and the reactor facilities produced therefrom or as a result of their utilisation;*

il) Any nuclear material supplied by the Soviet Union to India for use of the reactor facilities;

111) Any nuclear material, including subsequent generation of special material, produced, processed or used in or by the use of any other items referred to In this section;

iv) Any other Item required to be listed in the Inventory referred to in section 6.

The main part of the inventory listed in section 6 of the 100 safeguards agreement is more or less a reiteration of the above. The subsidiary part of the Inventory also listed In section 6, Includes 'any nuclear facility while containing, using processing or fabricating any nuclear material referred to In the main part of the Inventory.'

The list is broadly similar to the list outlined In the safeguards agreement in connection with the supply of heavy water from the Soviet Union, except for the underlined item in (1) above and another section of the safeguards agreement, section 5, which states, 'in the event that India should construct or operate reactor facilities, as defined in the section 1 (d). It shall arrange to submit such reactor facilities to agency safeguards before such construction or operation commences.'

These two taken together require that India should place under similar safeguards all reactors, based on the Soviet design, constructed in future in India, Irrespective of whether these were constructed with foreign help or by indigenous efforts as a result of the experience gained with the use of the currently supplied Soviet reactors. Thus India has, In effect, agreed to perpetuity and to pursuit clauses not only in respect of the Soviet supplied reactors but also in respect of ail reactors of the same design that might be built in India.

For comparison, if a similar clause had been part of the safeguards agreement In respect of the Rajasthan atomic power station, we would have had to put under safeguards not only RAPS but, in addition, the Madras atomic power station, the Narora atomic power station and all the CANDU-type atomic power plants that are being constructed or planned in India. Few would deny that such an agreement would have been a setback to Indian efforts towards self-reliance In the nuclear field. Yet in response to a question whether the latest safeguards agreement Is a setback to our goals of self-reliance, the minister replied in the negative.

There can be no doubt that the current safeguards agreement is a far more restrictive one than any India has agreed to so far. In fact, If a similar agreement had been entered Into by India In respect of the other power reactors, TAPS and MAPS, then for all practical purpose India would have been under fullscope safeguards. It Is true that the reprocessing plants and the heavy water plants would not be under safeguards. But since by virtue of the safeguards agreement all power reactors would have been covered by the perpetuity and pursuit clauses, all the nuclear material used, produced, processed in these reactors Including subsequent generations of special fissionable material would have been under safeguard and we would have had to put the future generations of breeder reactors under safeguards as well.

In fact, the implication of the minister's statement that the Tarapur and Rajasthan atomic power station safeguards agreements were broadly similar is Itself a misleading one. The RAPS agreement was a far more restrictive one than in the case of TAPS. As a matter of fact, there has been a steady deterioration, from the Indian point of view, in the terms the safeguards agreements, four in all including the latest one, that India had concluded with the IAEA.

Special Agreement

The first safeguards agreement was signed in January 1971 and was in respect of the Tarapur atomic power station. The agreement with USA regarding TAPS was a special one, since the nuclear fuel for TAPS was supposed to be supplied exclusively by the U.S. The safeguards were applied on the reactors at TAPS; any nuclear material, equipment or device transferred to India by the US; Any special material produced in India in, or by use of, materials or equipment or devices transferred to India; and any facility while it is containing, using, fabricating, or processing, any special nuclear material transferred to the government of india for, or special material produced at the Tarapur atomic power station.

In practice this meant that in addition to TAPS, fuel elements and the spent fuel, the nuclear fuel complex and the Tarapur reprocessing facility were under safeguards while they contained material to be used or used in TAPS. The

agreement did not cover the second and successive generations ol nuclear material obtained by the use of the spent material. In any case, It was expected that the spent fuel would be returned to the USA The safeguards agreement thus Included the perpetuity clauses but not the pursuit clause.

In agreeing to even such a limited safeguards agreements the Indian government stated explicitly that,' the government of India emphasises, in contrast to the position of the United States, that its agreement to the provisions of this article In relation to equipment or devices transferred pursuant to the agreement has been accorded in consideration of the fact that, as provided In this agreement, the Tarapur atomic power station will be operated on no other special nuclear material than that furnished by the government of United States and special nuclear material produced therefrom in consequence of which the provislons of this article In relation to equipment or devices in any case ensue from the safeguards on fuel.

In spite of such explicitly stated provisions, India found It difficult to break away from the agreement when the USA refused to supply fuel to TAPS. Eventually, of course, the agreement was transferred in favour of France which continues to supply fuel to TAPS and the safeguards agreement remains In place.

Similar Agreement

Soon after the first agreement, India signed a second safeguards agreements with the IAEA September 1971, which was in connection with the Rajasthan atomic power station. This agreement was somewhat similar to the TAPS agreement. The safeguards were to be applied on all nuclear material used or produced In RAPS. In addition to the nuclear material, the heavy water supplied by Canada was also under safeguards for a period of five years only, since upon the completion of the five year period, such heavy water was supposed to be removed from the scope of the agreement by retransfer from India to Canada or by substitution in accordance with established procedures.

In addition to this, the safeguards agreement stipulated that, 'nuclear material produced by the use during the aforesaid five-year period of such heavy water, and all subsequent generations of nuclear material produced in or by the use of such material, shall be subject to the implementation by the agency of the safeguards provisions.' Here we have the first application of the pursuit clause. However, In this instance it was limited to only a five year period during which the heavy water supplied by Canada was to be used In RAPS.

After that period, if India had used domestically produced heavy water in RAPS, the safeguards were to be applicable on only the spent fuel produced in RAPS but not on the subsequent generations of special fissionable material pro duced by the use of this spent fuel. More specifically, If India had used the plutonlum extracted from the spent fuel to fuel Its breeder. So In the second agreement there was a perpetuity clause and a limited period pursuit clause. A slight retreat from the first agreement but still acceptable.

THE Pokhran explosion altered the situation dramatically. With the withdrawal: of Canada from the project and with the domestic production of heavy water far behind schedule, India had to look for other sources of heavy water. Finally a third safeguards agreement, second with respect to RAPS, was signed with IAEA when the Soviet Union agreed to supply India with required heavy water. This agreement went far beyond the first two. The safeguards were to be applied to : heavy water supplied by the Soviet Union to India; any nuclear material, including subsequent generations of special fissionable material, produced, processed or used In the Rajasthan Atomic Power Station or in or by the use of any other facility while containing, using or processing any of the heavy water or any nuclear material under safeguards.

Thus perpetuity and pursuit clauses were applied to RAPS reactors, the heavy water supplied by the Soviet Union and all nuclear material used, produced or processed In or by the use of any item under safeguards. The scope of this agreement was far beyond anything even considered in the first two. Fortunately, the agreement was restricted specifically to RAPS and the heavy water supplied by the Soviet Union. Thus when India built and commissioned with indigenous efforts the Madras atomic power station, it was not covered under any safeguards agreement. The significance of this achievement should not be underestimated.

Unsafeguarded Facilities

There are currently five non-nuclear weapons states that have unsafeguarded (facilities of significance for safeguards, (Brazil, India, Israel, Pakistan and South Africa). Of these only India has so far managed to build and operate nuclear power stations without outside help and thus outside safeguards. In the remaining countries all their nuclear power station, either operating or under construction, are under safeguards and the Indian nuclear power programme did not envisage any further safeguards on any future nuclear power stations. At least till now. With the latest agreement, India has committed itself to subjecting, not one nuclear power station, but a whole class of nuclear power stations to safeguards. No amount of indigenous efforts can help us In breaking this stranglehold of safeguards. Now it is true that the wording of the agreement leaves some scope for manoeuvre in future, but that can sill lead to disputes and arbitration, a course of action full of uncertainty and pitfalls. The costs involved In the current course of action far outweighs any benefits that we can get. The benefit is 2000 MWe. The costs are politically far more. The current agreement falls just one step short of fullscope safeguards, something which we have been opposing consistently sofar.

In the international arena this question of full-scope safeguards has been a bone of contention between the nuclear weapon countries, alongwlth a number of developed countries and few developing countries especially Brazil and India. Some 137 countries have signed the NPT which, In effect, calls for fullscope safeguards. Among the non-nuclear states that have not signed the NPT. eight have significant, operational or planned, nuclear activities in their countries. These are : Argentina, Brazil, Chile. Cuba. India, Israel, Pakistan and South Africa. In five of these states unsafeguarded facilities of significance for safeguards are either In operation or under construction. Among these five, only India has serious civilian nuclear programme calling for substantial investment In nuclear power generation.

Internationally the efforts of the IAEA have been directed towards either bringing these unsafeguarded facilities in these non-nuclear states under safeguards or restricting the growth of such unsafeguarded facilities. Towards the latter end, the IAEA has been continuously strengthening its safeguards conditions. In the earlier years Its efforts were directed towards applying safeguards on specific installations or nuclear supplies. Later they began to apply the safeguards on installation and nuclear aterial.

The Tarapur and the first Rajasthan agreements belong to these types of safeguards. The safeguards scope was then expanded to Include pursuit clauses In Its totality. The second Rajasthan agreement is an example of this kind. Still the efforts were directed towards specific Installation. In the early eighties It began to adopt a different strategy. With the example of India, which had begun to build series of nuclear power stations on Its own but based on an Imported design In mind the IAEA began to insist on safeguards being applied on a whole series of, built, under construction or under possible construction, nuclear facilities.

Vandellos Plant

When in April 1981. Spain signed an agreement with IAEA in respect of the Vandellos nuclear power plant, the safeguards agreement called for safeguards on only the Vandellos facility along with safeguards on all nuclear material used or produced by the use of Vandellos facility Including subsequent generation of such material. However, when a couple of months later. In July 1981. Argentina approached IAEA for a safeguards agreement in respect of the Atucha II nuclear power plant, IAEA Insisted on applying safeguards not only on Atucha II but on "any nuclear facility designed, constructed or operated In Argentina on the basis of or by the use of the technological Information transferred from the Federal Republic of Germany to Argentina contained in design drawings, technical specifications, technical manuals for the operation and maintenance of the Atucha II Plant.

With this stipulation, the IAEA prevented Argentina from following India's example of building of similar reactors on its own and keeping them free from safeguards. The strategy was clearly to prevent the country from expanding its Inventory of unsafeguarded facilities, the underlying idea being that If you cannot get a country to either sign the NPT or accept full-scope safeguards, expand the safeguards conditions so that with a single agreement a large number of facilities can be brought under safeguards. In case of Atucha II the terminology was specific. In the present agreement that india has signed, the IAEA has used more general terms, it is Interesting to speculate whether this would result in a wider coverage than the Atucha 11 or a narrower one. In any case what Is Important Is the fact that there Is a fundamental conflict between the alms and objectives of the IAEA and India. The IAEA's aim is to get as many Indian nuclear facilities as possible under its safeguards coverage, thereby circumventing India's objections to either signing the NPT or accepting fullscope safeguards. India's aim Is to develop its indigenous nuclear capabilities with as little international safeguards, as exemplified by the NPT, as possible The present agreement is a clear victory for the IAEA. What Is not clear Is why the Indian govern ment and nuclear establishment agreed to con cede such vital principles to the IAF.A.

CHERNOBYL, CHELIYABINSK AND KOODAMKULAM

Glasnost and the Evasive Soviet Nuclear Industry

The civil and military nuclear establishment of USSR has even today remained as an island untouched by the social audit being Initiated under Glasnost. The civilian nuclear reactors produce 10% of the nations electricity. The military wing would become redundant if the peace talks succeed.

The Common Interest of the Nuclear Energy Lobby.

It has been argued that the USSR fully cooperated with the International Atomic Energy Agency (IAEA) and the governments of other nations in sharing the Chernobyl data. Such sharing with IAEA and nuclear establishments of other countries who all share a common bond of secrecy is of little relevance to the people. IAEA and the nuclear establishments of its member countries are promoters of N energy and as such any Information which questions the safety or economic aspect is anathema to them. Critical data like the probable health costs of an accident are neither sought nor given In IAEA gatherings.

Secrecy over nuclear matters is not a Soviet syndrome. Writes Stephanie Cooke, formerly managing editor of *Nucleonics Week and Nuclear Fuel :*

> It is an International masonic order of its own, with roots that lie in industry's birth place : the top security labs that produced the world's first atom bombs. (1)

None of the existing medical literature on radiation caused health hazards has originated from the scientists on the payroll of N energy establishments anywhere. The studies on environmental contamination and health effects In the western nuclear nations by independent scientists show that even under normal functioning, nuclear power is harmful for the entire life support system for many a generations. (2)

In the USSR, because of the support from the party and the state, the nuclear establishment retained monopoly over data and research. There was no visible anti-nuclear movement and counter-information base till Chernobyl.

The glut in Internal market ?

Opposition to nuclear power is gaining momentum In the USSR after Chernobyl. Construction work on six nuclear plants has been stopped. Other East European nations also are less enthusiastic now.

The Soviets first proposed to sell reactors to India during the early eighties. This has been frozen because of the full scope safeguards which would mean that the supplier would have control over the plutonium produced In indegenous reactors as well. This clause Is being reportedly diluted and the terms and price now offered are better than the earlier offer.

Did the USSR decide to do so because of a glut in reactor market in USSR and the Eastern Europe ? Before the transaction takes place, there should be a popular debate in both the countries centering the following issues :-

> Is it safe from a public health point of view, even under conditions of no Chernobyl type accident ?
>
> Is the reactor under negotiation relatively safer than the models involved in Three Mile Island and Chernobyl ?
>
> Has proper environmental Impact assessment been made before selecting the site for the proposed plant ?

This debate could begin with the limited and extremely fragmentary data on N Power in the USSR published in Soviet and international media. Here we will examine two cases : 1. the status and efficiency of N power industry in USSR which addresses Itself to the question of relative safety of the reactor under negotiation. 2. The response of the Soviet and International N establishments to two serious accidents In 1957 and 1986.

The Soviet Nuclear Industry

A UK Green Peace report quotes from Soviet newspapers about the bottlenecks in the nuclear construction programme:

> Chronic shortages of manpower, housing and materials have dogged most of the nation's nuclear sites and reactor manufacturing sites for more than a decade. The three large nuclear construction sites in the Soviet Union - Smolensk, Chernobyl and Leningrad-suffer from serious shortage of key materials.....

it is reported that only 10% of the 1430 tons of steel required to meet 1980 construction goals was delivered to the Chernobyl site. In the first quarter of the

 year, the plant was undersupplied with

6,500 cubic meters of reinforced concrete structures, hundreds of Kms of electrical cables and 12,000 ancillary equipments. No welding cable was sent In two years. (3)

Sovietsakaya Rosslya In a 1982 report quoted Nicholal Derkovitch, the then construction chief of the Balkavo nuclear reactor : "we ask for 12 millimeter sheet and they give us 20 mm. which is heavier and more expensive. When they give us 12 mm Instead of 20, of course we cannot work. Instead of giving us steel, they're giving us the finger, if you will pardon the expression. And as a result, we are violating every normal rule of construction technology." (4)

Eight years before the Chernobyl, Nikolai Dollezhal had complained about the low quality of materials supplied:

"the equipment delivered by plants must be nuclear class, as it has now become the custom to say. It is not possible to say that all is well in this respect. Although legalised standards and rules for the design and manufacture of equipment for nuclear power plants have already been In existence for several years, observance of a high technological level in production is not always satisfactory." (5)

Atommash

The Atommash, planned with an annual production capacity of 8 VVER 1000 reactors was supposed to be the show-piece of Soviet reactor technology. A new city was created at Volgadonsk, the meeting place of the Volga and the Don. Construction work started in 1972 under Italian collaboration. The reactors manufactured at the 10 Km long assembly line would be towed by barges up the Volga to Central Russia or down the Don to markets through out the Southern and Eastern Europe. The Green Peace Report says:

Atommash has been dogged by difficulties for many years. Originally It was scheduled to be In operation by 1980. It missed this deadline badly. In the 11th 5year plan (1981-86), Atommash was projected to supply a modest seven 1000 MW WER reactor to Soviet sites. But by late 1981, officials said a maximum of four might be provided. (6)

The mess at Atommash did invite the attention of politburo. In 1983, Vladimir I Dolglkh, CPSU secretary for heavy industries rebuked the Atommash management for "having for a number of years failed to observe approved technological procedures, for gross violation of state discipline, for gross deviation from design standards and for failing to insure the accident free operations of engineering communications." Deputy Prime Minister Ignatl Novlkov and Gennadi Fomln, Chairman of the State Committee on CMI constructions lost their jobs. (7)

Atommash is reportedly In more serious troubles. According to a New Scientist report by Zhores Medvedev, Its heavy foundations began to give way In 1983. ..walls collapsed and serious accidents stopped the plants operation. Reason : the three giant structures - Atommash, Energomash (heavy Industrial complex supplying steel for Atommash) and the city of Volgadonsk were built well below the level of the artificial 1080 Sq. Mile Tsimlyanskoye Sea. Since the exploratory bore holes were drilled too vide apart, the large underground cavities beneath the plant went unnoticed. These cavities we e filling up with water from the sea. The water table in the entire area has risen sharply in recent years, undermining all the three units.

The soviet scientists were toying with the idea of protecting the structure by freezing into permafrost the groundwater ladden soil of this temperate region. According to Medvedev, this is highly impracticable "the only real answer Is to transfer the plant, lock stock and barrel to a new firmer location." (8)

Safety Consciousness in **India and the** USSR

Several safety lapses on the part of Indian atomic establishment have come to light. Narora, where two 235 MY/ reactors are coming up is a seismic zone and IAEC claims that an earth quake will have no effect on the reactor. Chairman IAEC quotes the example of Soviet Union, which has six reactors In seismic zones.

According to a news report in Janayugom, the organ of the Communist Party of India, the work at the reactor being built at Kransnodar, a seismic zone has been stalled In response to the peoples protest. Does this shelving, Inspite of the huge Investment made so far, indicates that the Soviet authorities are not all that sure, while Indian counterparts still quote the Soviet experience.

At Koodamkulam, the proposed site of WER 1000s, no environmental impact assessment and a study of the feasibility of rescue work in the event of a major accident has been done.

The atonic energy establishment in India will have to tell the people as to how the WER reactor, built at Atommash will be safe. The Soviet authorities should also reconuider the Justifiability of exporting a potentially dangerous technology to **a** nation which does not even bother to observe the preliminary safety measures ?

Chernobyl

Information regarding the accident was relayed to the neighbouring governments on the third day, only after Sweden sought an explanation for the radioactive anomaly observed by their monitoring agencies. Dr. Rosalie Bertell wonders as to how the US spy satellite (which has resolution power to read a license plate number on earth and locate lost persons In wilderness area) missed the explosion, graphite fire and evacuation of 25,000 people in the vicinity of the reactor. (9) More serious lapses have been reported In the official version regarding the dose to the people and the health effects.

Dose from Chernobyl

As per the data provided by the Soviet scientists to IAEA experts, the total dose to USSR people was 2 million man selverts (1 Seivert (sv) - 100 Rems). The IAEA sources point out that it is 20 million man Sv. (10) Roger H Clark of NRPB UK says that this difference is due to the underestimation of long lived isotopes like cesium 137 (Half life-Tl/2 33 yrs), strontium 90 (T 1/2 27.7 yrs) and plutonlum 239 (T 1/2 25.000 yrs) (11)

Valery N Soyfer, the geneticist who founded the first molecular biology and Genetics laboratory in USSR questions the correctness of dose assessment:

> Immediately after the accident, the Soviet mass media talked about the radioactive Isotope of Iodine 131. Its half life is relatively small, about 8 days. It **was** reported that 50 to 80% of all radiation that fell to the ground was made up of this isotope.
>
> In reality, iodine 131 formed no more than 10% to 15% in most of the tests. The longlived Isotopes often formed more than one-third of the total of radioactive substances. Yet the estimate of the future increase in cancer deaths was based on the presence of iodine 131 in the radioactive dust that fell on that part of the Soviet Union where 7E million people live. (12)

While Information on dose from cesium was denied to the Soviet people, their scientists told the IAEA experts that 1 million curies of cesium 137 has been deposited in the European region of USSR (13)

Caucer consequences

The Soviet scientists estimated 4150 additional cancers over the next 70 years, which is 'less than 0.05% from the level of death rates caused by spontaneous cancer'. Dr. Robert Gale, the American who did bone marrow transplantation of Chernobyl victims predicted 6000 additional cases. (14)

According to John B Goffman, the disaster would cause an additional 951,000 cancers (half of them fatal) and 19,500 leukemias. Of this, 424,300 would be in Russia and 526,700 in other countries. (15)

Alongwith this gross underestimation there was total denial of any probability of genetic/congenital anomalies or abortion. In an IAEA meeting at Kiev, the Soviet scientists advised the people to shed what they termed as radiophobia, which was spreading in USSR. (16) Says Zoyefer:

> The amazing peculiarity of the Soviet report is that there were no reference to future Increase in herldltary disorders. Specialists In genetics know that the frequency of herldltary diseases is greater than the frequency of cancerous degeneration under the influence of the same doses. This correlation applies to the consequences of Chernobyl as well. (17)

The governments in the West did tell their people all what they knew about the possible consequences of the fall out. While in the US data on increase in radioactivity was available for the public, France even refused to provide the same inspite of a request by the NATO allies. (20) Ail governments however consoled the people that the future health effects would be negligible.

Cheliyabinsk

The USSR set up its first plutonlum processing plant at Cheyabinsk in the Ural mountains in

1947. The military establishment had, In the next two years amassed enough plutonium to detonate a bomb in Sept. 1949, on the 70th birthday of Joseph Stalin.

In 1957 an accident took place at Cheliyabinsk due to the explosion of the ammonium nitrate in the waste. Some 10 million curies of strontium 90 and other highly active elements like plutonium spewed into the surrounding country side. About 60,000 **people had** to be evacuated, 30 towns eliminated. Eye witnesses testified of vast territory laid waste and the road blocks and warnings to travellers. There were huge piles of contaminated top soil, the contaminated houses were pulled down to prevent their owners from retrieving the poisoned possessions. Thousands of people were hospitalised, the local people referred to the Urals as "the graveyard of the earth." (19)

The first report of this accident, more serious than Chernobyl, appeared in New Scientist after 20 years.

Cheliyabinsk also housed a Secret Science Centre, where majority of the scientists were prisoners. Immediately after the accident, another research lab was set up here under Al Burnazlan, a Leutenant general and also a Deputy Minister of health. The dissident geneticist Zhores Medvedev says that he turned down, the invitation to work at the Radiation Research laboratory, since it entailed curtailment of professional freedom to publish papers and also a strict surveillance by the secret police. (20)

The results of 30 year long observation of plant, animal and human life In the Urals have not been published so far. Dr. Nikolai P. Dubinin, a geneticist mentions of a 1970 report of the President of Soviet Academj of Sciences in which results of 11 years of experiments and observation at the Urals were quoted. In the contaminated area.

> Some species died out, some continued to suffer for a long time their population reduced In size and some evolved towards a higher resistance. Ail the fine trees in the area died out and about 80% of the bush trees were severely damaged. Higher plants and trees were replaced by radioresistant grass. (21)

In the International Conference on Genetics heid in the USSR In 1977 Dr. Dubinin spoke to 2000 geneticists from all over the world that "any further advancing along the path of uncontrolled damage to the biological basis of mankind's existence could bring about great losses in the biological quality of human population. The percentage of children in Industrialised countries born with congenital anomalies more than doubled between 1956 and 1977. (22)

According to Rosalie Bertell, CIA has 16 secret reports on Cheliyabinsk, which they would not release. (23) The USA is the biggest producer of nuclear electricity and spent fuel waste containing Plutonium 239, an excellent bomb material and breeder fuel. Yet, they do not have a spent fuel reprocessing plant. Did the USAEC shelved their plans after seeing the horror at Cheliyabinsk ?

The Medical Data Which Needs to be Reanalysed and Published

Soviet Union and the Comecon nations have a third of the nuclear facilities in the world. Naturally, a third of the victims of radiation exposure also. Their proportion could be higher In Soviet people, since they have to keep and reprocess spent fuel from the plants exported by them.

The nuclear science establishment of USSR has been observing the ecological effects of Cheliyabinsk accident for the past three decades. Similarly, the health status of workers and population exposed to "lower" levels of radiation from the "normally" functioning reactors might also have been monitored. Findings of these studies are not available to the International community. The health statistics like birth anomalles, sex ratio at birth, cause of death etc. have to be reanalysed with specific reference to radiation and other carcinogens. A collaborative efforts by the international scientific collective with no bias against the Soviet Union or toward nuclear energy would definitely Increase our chances of survival. Soviet Union can well afford to spend a minimum of five years in sorting out the unresolved safety problems of nuclear power with the support and goodwill of global anti-nuclear, environmental groups. Construction or sale of nuclear reactors to other countries can also wait.

Kremlin has allowed the hawks from Pentagon to inspect the nuclee- Installtions in **Soviet Union. Now, a few doves doing medical**

research must be allowed to see the voluminous health data of workers and people exposed to radiation from the civil and military nuclear programme.

From the statements of Dubinin and Soyfer, It seems that the damage inflicted on the national gene pool by the emissions and leaks from the nuclear fuel cycle Is likely to be massive and Irreversible. This invisible violence persisting even today in our soli, air and water might turn out to be more virulent, evasive and sustaining than the bulltets and barbed wires of the dark era. Glasnost demands that the killer be made visible.

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Can we afford Narora ?

As the countdown begins for the commissioning of the country's first post-Chernobyl reactor, the Narora Nuclear Power Plant, the campaign "Stop Narora" has barely a few weeks left to persuade the government to defer, if not altogether scuttle, a project on which It has already spent Rs. 532 crore.

In Narora, a Sanghursh Samiti Is mobilising people for a major protest. Early in September, 14 ruling party MPs from Uttar Pradesh submitted a memorandum to the prime minister to stay the commissioning of the Narora Reactor. Rajiv Gandhi Is expected to be receptive to a proposal for a dialogue on Narora with eminent citizens, as an image-building exercise.

Despite Chernobyl, for Rajiv Gandhi and the Indian atomic energy establishment, the promise of the nuclear dream remains Intact. If India is to meet the ever-growing demand for an assured source of power supply, atomic energy is alone the answer, Is the establishment view. Considerations of safety are brushed aside as the hobgoblin of technologically ignorant minds. "More people die from accidents than radiation hazards. The adverse impact of nuclear power on human life is far less than that of cigarette smoking. Nuclear power is as safe as any other source of power supply." These statements have been made by successive chairman of the Atomic Energy Commission.

What about the near disaster at the American Three Mile Island station in 1979 ? Former Commission chairman Raja Ramanna saw it as a demonstration of how well the "fall safe" principle of nuclear power reactors works. And Chernobyl ? WorldWatch Institute "State Of the World 1987" report points out, "Potentially health threatening levels of radioactive material was deposited more than 2000 kms from the plant in at least 20 countries." But here, undeterred by the Chernobyl cloud, faith in nuclear energy is nurtured by Doordarshan ad capsule on the goodness of energy derived from the atom.

If safety considerations evoke so little concern, what about the economics of nuclear energy ? In the 60s, the architect of India's nuclear establishment, Horn! Bhabha, used to speak of nuclear energy as being too cheap to meter. But today staggering cost overruns continue to plague nuclear power projects. In the case of the Narora Reactor estimated to cost Rs. 200 crore, cost overruns are likely to be more than Rs. 323 crore. This does not, of course, include costs for waste management. The chairman of the AEC, Mr. Srinivasan may glibly claim that the technical problems associated with the production of heavy water have been solved, but the facts are chastening. Till 1986, India produced not more than 24 tonnes of heavy water against an installed capacity of 301 tonnes and a requirement of 558 tonnes. About 131 tonnes of heavy water were Imported from the Soviet Union at a cost of Rs. 30.80 crore from 1980-82.

Financial problems, technical difficulties and safety concerns have elsewhere In the world resulted In a drastic reduction of the nuclear energy profile. But in India till recently critics of the country's nuclear policy were denounced as CIA agents. The department of Atomic Energy functioned virtually as a secretive sub government beyond accountability to Parliament.

The Comptroller & Auditor General's reports on MAPP and the heavy water plant in Tuticorin have came as a shock and changed the sacred cow status of atomic energy. It is now quite common for AEC chairman Srlnivasan to talk to the press or with anti-nuclear activists. Even the bete noir of the atomic energy establishment Dr. Dhirendra Sharma has been invited to address officials at the Bhabha Atomic Research Centre ! Only last month a press party was taken to the Narora plant where they were reassured by managing director about the special safety provisions of the plant. Interestingly, the party did not appear to include any of the correspondents who normally cover the subject.

Empty exercises in PR ? Perhaps. They are nonetheless Indicative of the pressure the anti-nuclear lobby In the country has successfully built up.

Narora has been the most controversial of the planned atomic power stations because of its situation : on the banks of the Ganga only 56 miles from the Marodabad belt of the 1956 earthquake. Going contrary to the conventional wisdom of never setting up such plants on alluvial grounds and fractured rocks, Narora was chosen for political considerations. This was despite the strong criticism of the site by the 1972 interim report of the Vegurlekar Site selection Committee for future power plants.

NAPP managing director now assures us that adequate care has been taken to ensure the stability of the plant in high seismic zone, never mind that the cost of redesigning the foundation structure at Narora has consequently qudrupled. But even if we were to accept that the country has been able to acquire the expertise to construct an earthquake proof building, what about the claim of Dhirendra Sharma. that several engineers involved with the project have expressed concern about the use of substandard material ?

On September 22, 1982 there was major breakdown in RAPP-11 due to a "manufacturing defect" in the "moderator heat exchanger (ME)", according to a report In *Sunday* magazine. Subsequently, Dhirendra Sharma was able to confirm from engineers or. the site that their counterparts who had pointed out the defect at the time of delivery of the MHE from Larsen & Tuobro had been overruled by DAE and transferred, Sharma in his book *India's Nuclear Estate* claims that L & T officially admitted that they received a concession from DAF. on the original quotations as they were unable to meet the standards stipulated.

The CAG report on MAPP also emphasises the existence of faulty material and equipment supplied by the contractor. For storage of helium and heavy water, 62 stainless steel tanks were erected between 1975 and 1979 after due clearance by the Quality Surveillance Wing of the DAE. However 22 were found defective and had to be replaced with carbon steel tanks. DAE explained that the 22 tanks had developed leaks because they were not used immediately, as MAPP was delayed by more than eight years.

Sharma is also sceptical about the confidence displayed In the "failsafe" systems all of which are electronically controlled and require a constant source of outside power.

Narora, he claims, suffers from the two very flaws singled out by Soviet physicist Valery Legasov : accident-prone construction and lack of reliable emergency systems. Even routine spillages of radioactivity into the Ganga will contaminate the remaining 1000 kms to the Bay of Bengal.

These fears may well be exaggerated, but we have a right to know about the risks Involved. Nuclear power requires an extraordinary faith by the ordinary citizen in the technical elite - a faith that has been badly shattered.

Demonstrations

About 60 young girls from Delhi squatted on October 6th, 1988 outside the gates of Narora shouting slogans like Parmanu Bijli bandh karo (stop nuclear power). The girls, from Delhi's prestigious Lady Shrl Ram College and Jawaharlal Nehru University, sat all morning effecting a partial rasta roko.

The students had come a distance of 125 km to this tiny town on the banks of the Ganga to |oin the first anti-nuclear demonstration at the site. The Students Action for Environment and the Women's Development Cell of the College had enthusiastically responded to the call from the Committee for a Save Nuclear Policy (CONSUP). Amidst gaily-coloured banners saying "Rs. 800 crore, that is cheap nuclear power", they sat in the blazing sun listening to Dhirendra Sharma's impassioned warning that while the Bhopal disaster had affected thousands, a mishap here would be much worse. "For 10 to 30 years of electric power you are endangering generations to come", he said.

Initially, a Delhi-Narora march had been planned, but few turned up on October 2 for the march and it was decided Instead that volunteers would travel to the villages neighbouring Narora and warn the people of the dangers of an accident in the Narora plant, which is located in an earthquake zone.

The volunteers had very mixed experience. At Ghaziabad when they put on a slide show in a temple, the audience which was expecting a feature film, turned hostile and flung mud at the screen, said a volunteer from the Network to Oust Nuclear Energy (NONE).

But at Dlbal, a few km from Narora, despite opposition from the local Congress-1 MLA, they were not only able to win the support of about 40 students at the Digambar degree college, but the principal even gave them money to get to Narora to join the demonstration Kuldeep Kumar, a young motorcycle mechanic, also came with them. For 12 years he had indifferently watched the shadow of the Narora plant steadily lengthen across the Ganga. It was only this week that he learnt what radioactivity could mean for them and the thousands of others in the neighbouring village.

He had read about Chernobyl accident but failed to make any connection between the gleaming with domes of the power plant coming up here and the explosion of the Chernobyl reactor. His friends at the college had no idea what radioactivity was. May be the science students knew, but certainly not the others.

Did the people feel that the nuclear power plant would be advantageous to them ? Would it bring employment, development of industries and electricity ? this correspondent asked. "What benefit, they are even taking our farm land away from us", Kuldeep said, referring presumably to the 15 km radius that the government Is obliged to maintain as a safety zone as per International Atomic Energy Association regulations. For most of the villagers, the danger of radioactivity is a cold abstraction, and the question of more adequate compensation for land taken over is far more emotive issue.

What about the 470 MW of power that the two nuclear power plants would generate ? That power is not for the locals. Kuldeep said, Engineers from the plant who frequented his shop had told him that the electricity was for industrial units in Kanpur.

Meanwhile, Dhirendra Sharma was elaborating on the differences between rural and metropolitan India. High technology as represented by the nuclear plants was for the cities, while those in the villages and small towns who bore the most risk benefited the least, Sharma stressed. "Reach out your voice to the hellcopters of Raj Bhavan, wherever he is", exhorted Sharma, referring to the prime minister.

But even were the voices of the demonstrators to reach the prime minister, It is too late for dialogue. The Narora Atomic Power Plant (NAPPS) Is scheduled to become critical' by the end of the year. According to project director Krishna Chopra, the process of commissioning the reactor Is well advanced. An application for heavy water has been made. The plant needs 235 tonnes of heavy water per reactor initially as coolant and moderator. Some 9-15 tonnes are required per annum as replacement for process losses in this natural uranium reactor.

However, In view of the disturbing reports about the indigenous heavy water production, the commissioning may well be delayed. The Madras atomic power plant suffered a 16 month delay in commissioning because of the non-availability of heavy water. Atomic Energy Chairman M. R. Srinivasan however maintains that the problems with the heavy water projects have been ironed out.

Project director Chopra easily brushed aside fears about the safety risks involved, "SAfety Is looked after in an absolute updated post-Chernobyl."

Sources: Rita Manchanda in The Indian Post, Sept. 23rd, 1988 and October 8th. 1988.

Editor's Note : The commissioning of the Narora reactor which was first stated for October '88 and then December '88 has now been postponed to March '89 May be al! ts not as well as the nuclear authorities would have us believe

NEW DIMENSIONS TO SELF-RELIANCE

A high-level cabinet working group was set up in December by West German Chancellor Helmut Kohl to Investigate accusations by West German federal prosecutors in Hanau that top officials from two firms had exported a variety of nuclear components and materials from West Germany to Pakistan, India and South Africa. The exports, which took place between 1982 and 1988, were in violation of West Germany's Foreign Trade Act. Key suspects in the case Include a past technical director of NTG-Neue Technologlen Gmbh (NTG), and the present director of the nuclear consulting firm Physikallsch Technlsche Beratung (PTB). Prosecutors say a third firm, Gutekunst, may have also been Involved by procuring tritium gas and nuclear technology for PTB and NTG, possibly in another country. The illegal exports reportedly Include both unspecified quantities of the tritium gas as well as tritium processing equipment. Tritium can be used as a neutron generator for a fission bomb.

In addition to transactions that are blatantly Illegal, exporters In Germany have taken advantage of loopholes In West German laws on nuclear materials (among the most lenient In Europe) to trade in what is being called a "gray market" In nuclear materials.

Alfred Hempel, a nuclear broker and former Nazi officer, whose West German company Rohstoff Einfuhr GmbH Is also being investigated, is said to be a pioneer In this flourishing "gray market". An article appearing in early January in The Wall Street journal describes some of Hempel's shadowy deals involving the sale of heavy water. The Journal also notes that Western sources estimate there are now 25,000 tons of heavy water in the world. About half of It Is In Canada, whose CANDU nuclear power plants require it to operate. However, Canada, says the article, imposes heavy controls on its heavy water business. Much of the world's other heavy water Is believed to be in plutonium production reactors operated by the "nuclear powers" to make atomic and hydrogen warheads. What portion of the remainder has spilled over into the "gray market" is unknown.

in one deal described by the journal, a chartered West African Airlines Boeing 707 left Basel, Switzerland on December 1, 1983, carrying 122 barrels of heavy water. Heavy water is supposed to be one of the world's most closely guarded materials because it is used in production of high-quality plutonium for nuclear weapons. But apparently nobody was on guard that particular afternoon. According to the paperwork accompanying the shipment, the flight was from Oslo carrying 15 metric tons of heavy water to Frankfurt, West Germany. In actual fact, the flight had gone from Oslo to Basel, where the cargo was sold by Hemple's Rohstoff Einfuhr company to a Swiss company, Orda AG. Then 6.6 tons of Soviet heavy water were added to the Jet's cargo. After it was

loaded, the Jet took off for Its ultimate destination: Bombay. Hempel, who as it happened, also controls the Swiss Company involved, made at least US$15 million on that deal.

According to Dieter von Wuerzen of the West German ministry of economics, even though these shipments were Initiated with a West German government Import certificate authorizing a shipment to Frankfurt, they were not covered by West German law - because, says the ministry, the flight never entered West German territory.

Hempel similarly manipulated IAEA regulations two years later In another sale to India. Under IAEA regulations there is a loophole that waives controls over heavy water shipments of less than a ton, so, In 1985, according to Swiss records eight shipments totalling 6.8 tons of heavy water from the Soviet Union arrived at the Zurich airport. All the shipments were, according to paper-work, destined for different customers all In Western Europe. However, at the airport the papers were changed, making It all one package. It was then rerouted to India. When Moscow was informed of the true destination of their sale, they checked the papers from the Soviet trade agency that dealt with Hempel. "They were In perfect order," said Moscow's man in charge. Some of the papers even had notations that the heavy water had actually been received by customers In Western Europe...

Criminal investigators in Norway and US officials are also Investigating Hempel, studying evidence that he has supplied nuclear materials to India, Israel, Pakistan, South Africa and Argentina, all of which are assumed to be (and some of which are known to be - why Is It the press still Ignores such obvious evidence, especially in the case of Israel?) involved In making nuclear weapons. What they are finding Is that Hempel uses a network of more than a dozen German, Swiss and South African companies to, as one US official put It, "dance on the edges" of international controls meant to limit nuclear proliferation. Hempel has also, beginning In the early 1980s, involved China In his many deals. China hasn't signed the Nuclear Non-Proliferation Treaty - not that it seems to matter whether a country has signed or hasn't, but a big deal is being made in this case of the fact that China hasn't. Anyway, to try to make a long story short, acording to The Wall Street Journal, US officials, who asked not to be named, say the Chinese deals were huge They apparently involved more than a hundred metric tons of heavy water to India alone. At the same time, US officials say, Hempel's companies sold "substantial quantities" of Chinese heavy water and enriched uranium nuclear fuel to the military junta ruling Argentina.

The Chlna-Hempel connection came at a time when the *US,* France and other Western suppliers were boycotting South Africa, trying to force it to open up all of its secret nuclear facilities to International International inspection In exchange for nuclear fuel. South Africa has never agreed to do that. It hasn't had to. With a little help from Hempel, at least 60 tons of Chinese enriched ura nium found its way there when South Africa needed it to start two nuclear power reactors.

Some of the questions Investigators are ask-Ing about this man's deals are rather Interesting. Information that has come out so far makes clear that successive Bonn Governments have protected West Germany companies exporting nuclear materials and technology to Pakistan, India, Argentina and South Africa. So questions like, how have West German government officials secretly helped Hempel sell nuclear materials are to be expected. But they are also asking questions like, how has a man, who several years ago flaunted his Nazi past by sending Christmas cards showing himself in his medal-covered Wehrmacht uniform, been able to deal so easily with officials in Israel, Norway and the Soviet Union.

Meanwhile... the federal prosecutors in Hanau are continuing with their investigation of the original scandal that led to the current allegations. That's the scandal involving Transnuklear, a company that transported and processed lowlevel waste from nuclear reactors until the West German government took away Its license. Well, It sems that over the last decade or so executives of this company had, among other things, been spending millions of Deutschmarks In unexplained payments and outright bribes. And when that came out, early last year, rumors about West German companies shipping plutonlum to Pakistan and Libya also surfaced (Anumukti voll. no. 4, Feb '88). Those rumours have not been substantiated...not yet. anyway.

Source *WISE NEWS COMMUNIQUE 3060(306.3053)*

'KAIGA CHALO' AGITATION BEGINS

There was a big meet at Karwar in Karnataka on 2nd October, 1988 Gandhi Jayanti Day to protest against the Installation of nuclear energy plant at Kalga. About 2500 activities from different parts of the state participated in the meet. Of these, about 500 were women. The majority of the demonstrators belonged to North Kanara district. The rest were from Shimoga, Mysore, South Kanara, Dharwad and Bangalore.

A procession was taken around the town with placards and banners. The processionists sang songs and shouted slogans. Despite poor weather the enthusiasm of the protesters was unbounded. They urged the government to scrap the project and save the people from radiation disaster and proliferation of radioactivity After the procession, a public meeting was held in the evening. Speakers requested the protesters to bring to a halt all work on the Kainga plant within six months and to ensure that funds from Kaiga were diverted to ecologically sound projects which would guarantee equity and employment for the residents of North Kanara. The meeting was held under the presidentship of Dr. N. Shanta Bhatt. Among the prominent speakers were freedom fighter H. S. Doreswamy, Journalist Nagesh Hegde. National Award winning film director Suresh Heblikar, Food scientist Dr. A. N. Nagraj and former MP B. P. Kadam all of whom reiterated their support for this popular people's movement.

The next day there was march led by Sri Vlsveswara Theetharu the senior swami of the Udipl Pejawar Mutt to the Kalga plant office. The marchers demanded the Immediate closing down of the office and stoppage of all work at the Kalga plant. 375 people braVed the hot sun and stood by the swamljl when he requested Dr. P. T. Tiwari, the director to the office to close down the office permanently. But he expressed his Inability to do so though he did close the office for the day. All the protesters were arrested when they tried to forcibly enter the office.

Before the satyagrahis dispersed, It was announced that a two district action committee would be formed at a meeting of taluka representatives. It was also decided that number of senior activists would tour the districts to mobilize the people for the next phase of the struggle.

The success of the Kaiga Chalo march was due to the untiring efforts of many activists from all over the North Kanara district and Karwar town. Special mention must be made of Dr. Kusuma Sorab and her volunteers of Sneha kunja. Shri An ant Hegde of the Seva Sagar trust and the volunteers of Parisar Samrakshana Vedike, Sirsi.

Based on a report by Kaiga Roko Action Front and an article by Shri H S Doreswamy in Vigil of 15/11/88

Debate On Nuclear Power

To the credit of the Karnataka government, it has honoured the word of the erstwhile chief minister, Mr Ramakrishna Hegde, who had promised to hold a national debate on nuclear power, following the controversy over the Kalga atomic power plant in Uttara Kannda district. This Is the first time that the votaries of nuclear power - led by Dr. M. R. Srinivasan, Chairman of the Atomic Energy Commission (AEC) - have met face-to-face with the "opposition".

Indeed, those who have been objecting to the use of nuclear power in India in general and to a location in the sensitive ecosystem of Karnataka's western ghats in particular can hardly be blamed for believing that the nuclear establishment has not only chosen to turn a deaf ear to criticism but also refused to part with Informa tlon on this vital issue. Only too often, the AEC more readily releases documents to the International Atomic Energy Authority than to critics at home.

Since both sides are too deeply entrenched in their own well-known positions on this contentious issue, it was too much to expect any consensus to emerge from the Bangalore meet. At best, as this writer observed, there should have been a dialogue, Instead of a duologue, so that the two could have heard out each other calmly. Acrimony, of which there was unfortunately too much, could have been avoided.

Nevertheless, the very fact that the debate was held was an important departure. The estab

lishment has agreed to appoint a retired scientist who will liaise between the two sides and provide Information. What is more, there will be repositories of official documents relating to nuclear power in major cities. Perhaps the imminent entry of Soviet nuclear know-how also heralds a new spirit of glasnost in the atomic energy 'state" here.

Cardinal Factor

Inevitably, the Bangalore discussions revolved round the cardinal factor, safety. As Dr Srinivasan remarked, "We must take risks because societies that have, have progressed. Nothing ventured, nothing gained." This was countered by the anti-nuclear lobby which pointed out that India's safety record at Tarapur and other plants was dubious. Medical experts drew attention to the incidence of mongolism among newborns In certain coastal areas of Kerala, where sands are radioactive, as well as to complications caused to workers at the Kalpakkam power plant.

While these "costs" of harnessing nuclear power can be argued ad nauseam, with both sides providing conflicting data, perhaps the more illuminating point of contention is the necessity of producing such power In the first place. Only too often, protagonists of nuclear and other forms of centralised systems of providing electricity equate "power" with "energy", as though the two were the same. As a matter of fact, even the catch-all "energy" they refer to is actually only commercial energy, while the bulk consumed in this country - particularly by the poor, both in villages and towns - Is fuel for cooking, and almost all of it in rural areas in non-commercial or collected "free" (with the labour of women and children).

As Dr Amulya Reddy, the wellknown alternative energy expert from the Indian institute of Science (HS), where the debate was held, argued, "Energy Is treated as an end in itself and the focus is on Increasing energy consumption." His case is amply illustrated by the experience of Karnataka. When environmentalists halted work on the Bedthi hydel project in the same district as Kalga earlier this decade, they calculated that the per capita rural expenditure on all forms of energy in the state had declined (at constant prices) from Rs.1.66 per month in 1951 to Rs.1.23 in 1976, even though the generation of electricity had increased ten-fold in the same period.

Crying Need

The pro-nuclear lobby asserted, persuasively, that this form is not only cheaper than hydroelectric of thermal power - not to mention renewables like solar and blogas - but also that it has no adverse environmental effects. Unlike hydel, It does not flood vast tracts of forest; unlike thermal, It does not pollute the atmosphere. Mr S.K Kattl, who heads the Nuclear Power Corporation, stated: 'There Is a crying need for power from any source".

However, the old claim that nuclear power would become "too cheap to meter" appears farfetched today. Despite what Dr Srinivasan maintained about more countries going nuclear, the industry has suffered a setback, especially after the Chernobyl accident. What is more, even on its more attractive advantage - its low cost per unit of power - it can be faulted. Dr Reddy has shown that if three elements are included in costs: the AECs actual performance in completing power plants (15 years instead of eight), proper waste disposal practices and the comptroller and auditor general's estimates for heavy water, the cost per kilowatt-hour can rise to 122 paise from the AECs 99 palse, while thermal power costs only 101 palse.

Because the nuclear industry, worldwide, faces an ever-increasing cost escalation as public awareness about its hazards continues to grow (particularly after Chernobyl), attention must be drawn - when planning a new station like Kalga - to alternatives. The first is to save a kilowatt, instead of producing one more. In Karnataka, as throughout the country, as much as 22 per cent of the electricity produced through centralised power systems is lost on transmission and distribution. if various conservation measures are taken at the point of consumption, every kilowatt thus saved is equal to 2.03 KW generated, as pointed out by an expert group's perspective plan for Karnataka.

Some of these conservation measures include modernising the state's power-intensive industries (like the private sector aluminium plant in Belgaum), making irrigation pump sets energy-efficient , replacing conventional bulbs with fluorescent ones and electric domestic water heaters with solar appliances, and using LPG instead of electricity for cooking. The plan showed that with these five measures alone, Karnataka's power deficit for 1986-87 would become a surplus of 458 MW the equivalent of two Kaiga-type 235 MW reactors.

The need to conserve pOnver, before producing more of It from centralised systems, should be apparent from the fact that big Industrial units account for no less than 70 per cent of the electricity consumed In Karnataka. Whatever the other benefits of these Industries, their employment potential Is extremely small, which prompts a re-examination of the social benefits of concentrating such a large chunk of financial and physical resources in this one all-important sector. Nationally, power received nothing less than a fifth of the total investment In the Seventh plan.

If one reverts to the earlier observation that It Is the total energy that Karnataka should be worried about, and not Just the generation of power. It Is clear that renewable forms ought to be given much more emphasis. (The country-wide picture is no different, with these receiving 0.3 per cent of the Investment in the last plan.) With some 13 million cattle, the state is as well equipped as almost any other to meet the energy needs of Its population from gobar gas.

According to Prof K.S. Jagdish of the IIS, with a low output of 4 kg of dung per head of cattle a day, It should be possible to produce sufficient blogas, with which an electricity capacity if gen erated for eight hours every day of 250 MW can be created. In other words, each village can reap the benefits of a 10 KW power station. He also advocated the conversion of wastelands Into firewood and foddar plantations, as well as the replacement of bullock power with biogas.

Energy Scenario

For such a transformation of the energy see nario to take place, of course, the essential pre requisite is the proper management of the "commons". The task could be undertaken, rather like the mandate given to the National Wastelands Development Board by Mr Rajiv Gandhi, over a five-year period. As Prof Jagdish argued, "This approach solves at one stroke the problem of soil erosion, high rainfall run-off due to deforestation and the shortage of rural energy". Such a holistic and reinforcing solution would also attend to the dilemma of mass unemployment, unlike the path carved out by centralised energy provision.

The location of the Kaiga atomic power plant does precisely the opposite. Quite apart from the safety hazards and ever-escalating costs, the very site on the western ghats, from which sever al rivers flow, militates against that new "buz zword": sustainable development. Very simply put. It amounts to a choice between generating power from two 235 MW atomic plants at Kaiga (four more have recently been sanctioned there) or meeting the energy and employment needs of the entire state, with all the spinoffs of environ mental enhancement.

Courtsey DARRYL D MONTE Times of India 23 12 88

LETTER BOX

By reading the articles, of the August issue I felt very upset. I thought that Anumukti would guide the antl nuclear movement In India. For this, It is necessary to collect and publish Information on anti-nuclear movement as well as expose the activities of our Atomic establishment. On 6th August, there were processions in Kakrapar, Bombay & Calcutta against Nuclear Power. Comments of V. Legasov published in Moscow News (July 17, 1988) could be reproduced In Anumukti.

We are trying to organise movement against the proposed Nuclear plants in West Bengal. But Anumukti won't provide any guide for our would be activists.

Niranjan Haldar
79, R. K. Ghoshal Rd.,
Calcutta-700 042.

Editor's reply :

What males nuclear industry so Irresistibly attractive to leaders' of third world elites is the possibility of producing a nuclear arsenal from Its waste products. The August Issue was devoted bringing out this connection In detail. Regrettably the publication of the August issue was delayed. I had given the complete 'matter' to the printers on 3rd of August hoping to post the Issue by the 15th. Unfortunately due to a death at the printers and the resulting disorganization I received the printed copy only on the 26th of September. Consequently there was no possibility of including reports of protest demonstrations which took place on 6th and 9th of August. The present Issue does contain reports about protests in different parts of the country. I still cannot Include a report of the Calcutta demon stration since I have no information about it and

your letters was the first 1 heard about it.

Anumukti cannot fulfill its function of being a link between groups of activist in different parts of the country unless activists themselves feel the need and send reports regarding their activities to it-

Received your Journal Anumukti of August 1988. This type of Journal working for non-nuclear India is essential at this stage because now our country has got a number of nuclear plants In different states and Intends to open more. Anumukti must create awareness in the people. Articles, especially like 'Daughter of the A - Bomb' must be published, which highlight the III effects of Nuclear Bombs. Congratulations.

ASIAN YOUTH CENTRE
H. Q. 37, Melpadi Muthu Street,
Nungambakkam, Madras - 600 034.

Mr. M. R. Srinivasan, Chairman of the Atomic Energy Commission recently announced a programme for 12 new nuclear power reactors with a total capacity of 6000 MW to be set up as a part of the 10000 MW nuclear power programme by the year 2000. In view of the secrecy surrounding the AEC working, It would be too much expect more Information than whatever has been announced till the plants are set up.

This programme will not come up for public debate. There may not be any avenue for submitting objections like the enquires that Department of Environment organises for other projects. Should we take the AEC 6000 MW programme low lying or shouldn't we put up a concerted stand on a national basis ? The-AEC announcement should not go unchallenged or unopposed.

KISAN MEHTA
Save Bombay Committee
C/o. KAYJAY ENGINEERS
123, Mahatma Gandhi Road,
Bombay - 400 023.

The August Issue of ANUMUKTI contained some Interesting and moving articles. Sri Lanka is a country without nuclear energy plants and without atom bombs. Nevertheless, the problem Is one of concern for the whole of humanity. We recognised this fact when It was made the topic of the daily meeting in our pirivena (monastic school) on Hiroshima Day and also in the meeting of the Mahila Samiti based at the temple, the next day.

It has to be mentioned that the rural population here doesn't have a perspective which reaches much beyond the southern areas of Sri Lanka. On that day, however, for the first time the ladles of the surrounding villages started to think for the whole humanity. They understood that the nuclear question Is also their problem and decided to build up a strong women's organisation to conduct a public programme with a silent procession of mothers and children, prayers and meditation on next Hiroshima Day. Issues like this one and other environmental problems which threaten human life on the whole earth, we hope, can be made a permanent part of the traditional programmes in our temple.

Dr. Ven O. Sobhita
Sri Bodhiraja Bhikku Training Centre,
Embilipitiya, SRI LANKA.

I brought a confidential report from Sweden, IAEA' Board of governor's Safeguards implementation Report for 1986, date 4 May, 1987. It is a 68 page document. If any one is interested in getting a copy against payment, he may write to me. SIPRI-1988 report describes Nuclear weapons situation in China, India and Pakistan. Copies are available with

Mr. R Dasgupta,
49/4. Hindustan Park,
Calcutta-700 029.

N. Haldar
79, R. K. Ghosai Rd.,
Calcutta - 700 042.

Going through your number of August 1988, found some spelling mistakes. "Hypocrisy: spelled as "hypocracy". The latter spelling Is wrong. Similarly "Occurences" Is spelt as "Occurances". I did not read the magazine thoroughly, I Just went through the sub-titles and found these two glaring mistakes.

D. N. Mittal;
Guru Nanak Pura,
BASSI -140412.

Editor's reply : I am solely to blame for these errors. My spellings have remained a constant source of exasperation to all. Since I am also Anumukti's only proof reader, a solution is not easy to find. Deeply regret, and promise to Improve in the future.

THE BANGALORE WORKSHOP

The National Workshop on Nuclear Power Projects with Specific Reference to Kaiga, organised by the government of Karnataka was held in Bangalore on December 10th and 11th, 1988. It was a unique event which brought together both antlnuclear activists and the nuclear establishment to share the same platform and almost equal time.

The scene of the confronation was the auditorium of the Indian Institute of Science. The debate at times grew rather acrimonlus. Elsewhere in this Issue we have published other accounts of the proceedings.

First it is important to understand what the workshop was not. It was not an exercise in creating an informed public opinion - an attempt at educating the public about the pros and cons of nuclear power. Therefore, It was a close-door, by Invitation only affair. A gathering of the experts' and a gathering for the experts. Neither was the workshop an expression of the open mindedness of the Karnataka government regarding the nuclear alternative. Despite assurances by ministers during the opening session it was clear from the very beginning that the decision on siting the nuclear power plant at Kalga did not depend on the outcome of the deliberations at Bangalore.

However, in a limited context, the workshop was a very useful meeting. The nuclear establisment was represented in full measure. All the big shots were present along with most of the second line. Glasnost' was a much abused word. The workshop did serve many useful functions however, and can be thought of as a milestone on the road to a non-nuclear India.

Firstly it showed unambiguously to everyone, (including some sceptical activists themselves) that the antlnuclear movement has gained a certain maturity. The arguments are no longer exclusively emotional - based entirely on a sense of moral outrage. The moral passion still underlies the foundation but it is reinforced by a technical understanding . The bland reassurances of the nuclear establishment - "leave the nitty-gritty to us" - no longer suffice.

A very large number among the scientific community share a feeling of vague unease regarding the nuclear enterprise. Normally these feelings remain amorphous. The forceful articulation of antinuclear views at the workshop helped many 'neutrals' to make up their minds. This side-effect of the workshop would greatly help the movement in the future.

Thirdly, the workshop was a place where one could learn new things. Two facts gleaned there deserve special mention.

1. Indian nuclear programme is based on reprocessing of spent fuel. Contrary to the practice in other countries the earlier policy of the Department of Atomic Energy was to locate reprocessing plants at reactor sites. This raised (by a large amount) the radiological burden at the site but it did avoid the dangers involved in transporting of highly radioactive spent fuel, (see Anumukti vol 1. No.3, Dec.'88) However now, unannounced, there has been subtle shift of policy. Thus, though there Is a reprocessing plant at Tarapur and another is under construction at Kalpakkam, the department Is ambiguous about whether there would be plants at Kalga and at other reactors sites. Meanwhile without as much as a by-your-leave of the residents enroute. It has started transporting spent fuel in trucks over thousands of kilometers. Spent fuel is extremely hazardous, and an accident Involving It could be a major calamity. The right of informed consent is a cornerstone of any system based on natural Justice and ought to be respected by all - even by sacred cows like the D.A.E.

2. The breathtaking announcement by the chairman of the Atomic Energy Regulatory Board (AERB) who said that site selection was political decision and the AERB was in no way connected with it. This, while the atomic energy establishments all over the world spare no effort at assuring the public about the great care that goes Into all aspects of safety of nuclear plants starting from site selection, (see the note following this article)

The most useful outcome of the workshop was the reluctant admission by the establishment of its duty to provide factual Information to the public. Specific reports like the Sriram report on Tarapur and the Ramarao report on Rawatbhata would be made available in some public libraries.

Dr. Ramanlah, the president of the Indian Nuclear Society was designated by the chairman Dr. M.R. Srinivasan to co-ordinate this. Any activist desirous of any specific report or Information should directly contact him. His address is:

Dr.M.V. Ramaniah
Indian Nuclear Society
Engineering Hall No. 7
BARC TROMBAY
BOMBAY 400 085

SURENDRA GADEKAR.

NO COMMENTS!

The Search for an Ideal Location

Where a nuclear power plant is located can affect its safety and ultimately the public health and ecological balance In the surrounding area. Before a site is selected, many factors are carefully assessed to determine, as far as possible, whether the Interaction of a plant and Its site would be harmonious or would pose unacceptable risks to safety. How susceptible Is the area to earthquakes and other extreme environmental phenomena ? Although plant design can counter many potential safety hazards, others many present difficulties so formidable that they are best avoided altogether through the selection of an alternative site.

A proposed site is also viewed from the perspective of how population density, patterns of water and land use and other features would influence any radiological effects of the plant under normal operating and accident conditions. As a corollary, the feasibility of emergency plans are studied, such as the availability of transport and communication network.

Source : Basic Safety Principles for Nuclear Power Plants : Highlights of a Report of the International Nuclear Safety Advisory Group (IAEA Topics June'88)

The selection of the site of a nuclear power plant is a political decision. The Atomic Energy Regulatory Board is net involved in the site selection process.

Source : Dr. A.K. De, Chairman, Atomic Energy Regulatory Board at Bangalore, December 11th, 1988.

ANUMUKTI

A JOURNAL DEVOTED TO NON NUCLEAR INDIA

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A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

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"No power is as expensive as no power."
Dr.Homi J Bhabha

The father of the Indian atomic endeavour was a dreamer. He dreamt grand dreams: of catching up with the West; of breaking the vicious circle of poverty; of unlimited growth. His answer to no power was "nu power". Nuclear energy was to be The Answer. Its task was to take India to its rightful place in the new world of plenty for everyone.

Four decades on, the answer does not seem like an answer anymore. There are just too many questions attached to it. What then, are the answers? Is there an alternative to nuclear power? What is the 'a y out? Will poverty ever vanish from this land?

The energy establishment today, like the political leadership, is not made up of dreamers- but rather by schemers. Their thinking is immobilised by self constructed mental blocks. Like the Bourbons of France they have "learnt nothing and. forgotten nothing". The nation strives on, borrowing more and more from abroad, lurching from one crisis to another, beset by endemic power shortages, hoping against hope that the latest 'temple' of modern India would somehow ease the situation.

The real energy crisis - women walking yet more miles for firewood; nutrient rich biomass ending up as smoke and adding to the greenhouse effect; the resultant deterioration in soil fertility requiring ever larger quantities of chemical fertilizers . . . . is not of concern to the power obsessed.

"How much land does a man require?" is the title of a short story [by Tolstoy. It beautifully illustrates our present condition. Like the protagonist in the story we are running wildly, trying to gather more and more while the target seems 'farther than ever. If we are not to kill ourselves like him, we need to pause and think.

Do we need energy per se or do we need energy for accomplishing certain tasks? Can we do these tasks using less energy? Is electricity synonymous with energy? Who needs and gets electricity? How much is enough? What is the relation between the deepening ecological crisis the loss of traditional sources of energy to the common people, the increasing role of the commercial' sector and

the grandiose dreams of power? How long will the present system, based on conspicuous consumption by a few and enormous waste by all, last?

Today Bhabha's dictum stands on its head. No power is cheaper than no power (unwasted power). Others use ten times less power than we do to produce the same quantity of goods. By far the overwhelming portion of new energy all over the world during the last fifteen years has come from increased efficiency and less wastage.

India is not a poor country. There is enough for everyone's need. What we need is to get rid of the greed and the greedy. That is the way to Swarajya.

Surendra Gadekar

"Energy and Environment" is the title of a course offered by the Sampoorna Kranti Vidyalaya in Vedchhi, Gujarat. The duration of this course would be approximately three months beginning according to the convenience of the participants as well as the Vidyalaya. The course is open to young men and women interested in the subject who are able to read English and are able to study independently under the guidance of an instructor. Other courses at the Vidyalaya - a non-violent training centre in the tradition of Gandhi, Vinoba and JP - are "Ahimsa and World Peace" and "Revolution in Theory and Practise". For more information, please contact Editor Anumukti.

Bursa's Forests in Danger

The Asian mainland's largest .tropical forest area is now in grave danger of being denuded as demand for Burmese wood increases, making the export of tropical wood a very lucrative business in Burma.

Some time back, Thai authorities issued a decree revoking all logging concessions nationwide. Since then, there has been a rush by Thai businessman and bureaucrats to make timber deals with their counterparts in Burma and Laos.

Unlike India or Thailand large parts of Burma are still forested, with deciduous teak forests in the mountains and monsoon forest' in the south.These forests are a home.to many indigenous tribes whose very survival depends on the forests and its resources. They are also a home to hornbills,tapirs, rhinoceros, and wild elephants.

The military government in Burma has stepped up the export of Burmese hardwood to Thailand. According to news reports from Rangoon, Burma has already auctioned some U.S.$3.28 million worth of teak to timber firms from Japan, Europe, Singapore, Thailand, India and Hongkong. The current developments clearly indicate that logging activities will be intensified and if unchecked, Burma's magnificent forests will very soon be a thing of the past.

Khor Kok Peng
World Rainforest Movement
Source: 'Third World Network

*

A study by the Rocky Mountain Institute in the U.S. says that a massive worldwide nuclear power programme in which a transition from coal to nuclear electricity is completed by 2025 would not only not solve the global warming problem, it would actually contribute to the effect. This is because investing in nuclear capacity would preclude investment in more effective carbon dioxide

abatement .strategies. The study finds that money spent in building nuclear power stations could do seven times as much good in diminishing greenhouse effect if it was invested in improving energy efficiency.

Source: New Scientist 5.11.'88

A Paradigm Of Plenty For Ever

We are in the midst of a major ohange in our way of thinking about energy, and for that matter about every other natural resource. The old (and still largely conventional) supply-obsessed approach to energy is running into more and more serious difficulties. A new development focussed paradigm for energy use and supply is emerging.

. The conventional "wisdom" on energy planning is as follows: development = growth = energy = centralised electricity generation and grid distribution.

Most of the steps in this argument are highly questionable, if not patently false. Development should not bo confused with growth in the volume of goods and services. If development is to lead to reduction of poverty, then the structure and the content of growth, as well as the distribution of its benefits, should be seen as being as important as the magnitude of growth. The benefits of growth do not necessarily trickle down to the poor, because its main beneficiaries invariably turn out to be the affluent. Growth does not necessarily lead to development.

Two Conditions

The second step of the argument reflects the widespread belief that there can be growth if, and only if, there' are increasing inputs of energy. But this correlation is valid only under two conditions: There must be no changes in the product mix of the economy; (For example, there must not be a trend away from energy intensive to energy saving products and processes.) And/or there must not be significant improvements in end-use efficiencies. For if either of these changes take place (and both have been observed in modern times) then there can be an increase in the GDP despite a decrease in the energy consumption.

The third step, which equates energy with electricity, is illustrated with the fact that the , central Ministry for Electricity is called the Energy ministry. In fact,, till the oil crisis, energy planning used to mean electricity planning.

The undermining of the energy = electricity approach really began with the almost complete domination of the transport sector by petroleum. But, oil has also had a rising share in the domestic, industrial and agricultural sectors. Thus the assumption has grown that for most of these end uses there is no alternative to the use of petroleum derivatives. Hence, *a* modern addendum to the conventional "wisdom" on energy: development = growth = energy = oil = engines, furnaces, and other heating devices fuelled by petroleum,derivatives.

But, just as electricity is not merely large scale centralised generation and grid transmission, the use of petroleum derivatives is neither inevitable nor unavoidable: alternative devices can be fuelled with ethyl or methyl alcohol; cooking can be done wih producer gas or biogas; and furnaces can be run on producer gas generated from wood. The basic flaw in the conventional approach to energy described above is the implicit belief that energy is an end in itself. Further, by adopting growth as an objective, and then believing that growth requires increasing energy inputs, the emphasis turns to energy consumption and therefore to the projection of energy demand.

These projections are usually distorted by several biases:

1.Current growth patterns are socio-economically just and ecologically sustainable.

2. That the prevailing distribution of energy need not be" questioned .or modified.

3. That the current efficiencies of energy generation distribution **and**

utilisation will prevail even in the future.

Energy planning thus becomes an exercise in increasing energy consumption. in the search for energy supplies, the large scale sources inevitably attract most of the funds. Thus the vast differences between the budgets of the ministries of petroleum, coal, (electrical) energy, and atomic energy on the one hand, and the budget of the department of non-conventional (small scale) energy sources.

. Demand management is ignored and what is left is the energy version of the supply, side economics.If at all conservation and efficiency improvements are given any attention, it is only as after thoughts, add-ons and retrofits for cosmetic purposes.

The R & D is also largely restricted to the supply end of t.he energy spectrum, and furthermore to the large scale energy sources. In fact the end-uses and therefore the human aspects- of energy are not even considered to be legitimate subjects of technical study by the science and technology establishments.

Fortunately, this supply-sided approach to energy planning is breaking down. It is becomming clear that growth, unconstrained by equity and justice, bypasses the poor. If development is to be our goal, then the emphasis must be on the immediate and direct satisfaction of basic human needs, starting from the needs of the neediest.

The present patterns of growth are becomming unsustainable because they extrapolate to impossibly high Values of future demand. The easy sources of energy have long since been harnessed, and the remaining sources are becomming more and more difficult and expensive to tap. More dangerous and unforgiving technologies demand more stringent safety measures which are inevitably more expensive.

Marginal Cost

All this means that the marginal cost of generating the energy carriers (i.e. the extra cost of producing the next kilowatt of electricity or the next barrel of oil or the next tonne of coal) is increasing steadily. The real cost of energy is therefore increasing and at the same time there is increasing pressure to devote an ever rising fraction of public funds to energy generation.

The production of energy (electricity, oil,coal) is * also associated with environmental impacts. The victims of these environmental consequences are becomming the basis of growing protest movements. Whether it is a large scale hydroelectric project or a super thermal plant or a nuclear reactor, there is a rising storm of opposition. Finding themselves hamstrung the supply lobbies accuse the environmentalists of blocking "development", even though 'what is being obstucted is growth in the interest of the affluent. But actually it is the environmental impact of energy supply which is accumulating and gutting in the way of further increases in energy supply. Hydroelectric projects often require large scale destruction of prime forests and this destruction is said to diminish the rainfall upon which the projects depend.

Inefficient Use

Energy is used very inefficiently today. Hence there are tremendous opportunities for efficiency improvements. If such opportunities are seized, then growth will not necessarily require corresponding increases in energy supplies. And, using currently available energy supplies more efficiently may make more economic sense than generating more energy to sustain prevailing patterns of inefficiency. But as long as the preoccupation is with supply, the efficiency with which energy is used, will only be given peripheral attention.

From the standpoint of technical efficiencies, energy sources should be matched to energy utilizing tasks. And since these tasks are varied in nature, a mix of energy sources is invariably essential for an energy system. Although, electricity is the best carrier, the cost of transporting it do increase with distance. Hence beyond a break-even distance, decentralised generation from local sources may turn out to be more

economical than the total generation plus transmission costs associated with centralised generation. It is in the context of this failure of conventional "wisdom" That a new approach to energy analysis and planning is emergi: g.

Hew Paradign

The essence of the new paradigm is that energy is only a means to an end, not an end in itself. The energy system must contribute to the goals of equity, economic efficiency, environmental soundness, long-term sustainability and self-reliance. This necessarily means an emphasis, not on energy consumption but on energy services, end-uses and needs. The spotlight in this new development fooussed end-use (defendus) approach is on human beings and the services that the energy provides for them, the tasks that it performs and the needs that it satisfies.

The starting point of the defendus approach is the detailed scrutiny of demand through a disaggregation of energy consumption beyond sectors and consumers to end-use devices and energy services. It may involve new carriers and new end-use devices.Even traditional carriers (e.g.biomass) may have to be converted into new forms (producer gas) or utilized in improved devices. Energy consumption must also be disaggregated beyond consumers in order to determine who are the beneficiaries of energy supplies and whether current distribution patters are consistent with development.

A central and integral part of the new paradigm' is the conviction that energy sources are finito and their extraction involves both economic and environmental costs. Consequently, in every attempt to maintain or improve energy services, a decision has to be taken whether to go in for efficiency improvement or For supply increases or for a mix of both. It is quite irrelevent whether these services are provided through improved utilisation technologies, or through energy supply schemes. Both have to become open contenders for the provision of energy services.

Decision makers must . therefore summarily reject all proposals that are exclusivly devoted to either supply or to conservation. The only one that should be tolerated must be proposals for the provision of energy services, and in these proposals both the options of energy conservation and energy supply (as well as combinations of supply and conservation) must be treated explicitly and compared fairly.

Bright Future

In the past, projects for supply increase have been the reflex-like response of the energy establishment. Efficiency improvement proposals have emanated from outside the establishment. This bias may have been justified when the demand was low, capital was in plenty and there was no urgency. But recent analysis both in other countries and in India, shows in case after case, that it is far cheaper, quicker and environmentally sounder to use energy more efficiently than to increase supply. Very approximately, it is two to three times costlier and it takes three to five times longer to generate a megawatt than to save it. For example, a 30% saving in power corresponding to 120 MW can be achieved by introducing in about 1-2 years simple efficiency improvements in Karnataka's 500,000 irrigation pumpsets at a total cost of about Rs.50 crores, but it would take Rs.120 crores and 5 -10 years to construct power station facilities to generate 120 MW. In this example efficiency improvement cost about Rs 42 lakh per megawatt compared to about Rs.1 crore per megawatt for generation.

There are innumerable other possibilities. There are enormous saving possibilities through the use of solar water heaters and fluorescent lights in all-electric homes which .consume 15% of Karnataka's electricity, and through fluorescent lights in non-AEH homes (which account for 7% of consumption.) The magnitude of energy demand depends very markedly on what efficiencies are assumed for energy generation, transmission and utilisation. Hence, it is only after decisions are taken regarding the generation-conservation

options that a picture'of future energy demand can be sketched. But to the extent that the efficiencies are matters of deliberate implementation, future energy demand is a matter of choice, not destiny.

In . taking these decisions, a crucial goal is to minimise the environmental impacts of energy generation, transmission and utilisation. The old bias for supply increases through centralised non-renewable sources has to give way to unbiased decisions between:

1. efficiency improvements vs supply increases
2. decentralised vs centralised production
3. renewable vs non-renewable sources of energy

The decision makers must be neutral umpires rather than partisan supporters. These choices are mutually related. With increasing efficiency, the magnitude of the final demand decreases and with decreasing final demand, a greater variety of supply options (especially those related to decentralised renewable sources) become serious contenders for providing energy services. Thus, . the outcome of the defendus analysis and planning is likely to be a lower cost, quicker, environmentally sounder, sustainable solution to the energy problem. What is likely to emerge is a solution that is not only consistent with other societal problems but also one that points to a brighter future.

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Enough For Everyone?

We have become used tb living in an era "where the resources no longer limit decisions but rather the decisions make the resources." The attainment of escape velocity in development has resulted in a tremendous guzzling of energy resources. Half of all the energy consumed by humans in all history has been done within the last hundred years.

Such an increase in energy consumption has lead to a deterioration of the environment. Today India consumes between 200 and 300 million tons of firewood every year. This means that nearly 700 million trees are being cut every year only to meet cooking and hot water needs. Fortunately a good part of it comes from barks and twigs in village woodlots, minor forests and roadside plantations.

A good housewife will balance her budget within the monthly income of her family and only under emergencies will she dip her hand into the storage kitty. This prudence introduces longterm stability into the lifestyle of the family. A similar approach is necessary in energy planning for a district or a state or the country.

Instead, what we have in the name of energy planning today in the country is pure . chaos. There are as ' many organisations dealing with different aspects of energy as there are energy sources and end uses. Thus, Coal India "produces" coal; Oil India and ONGC "produce" oil; Nuclear Power Corporation and the State Electricity Boards "produce" electricity: many agencies manufacture end use devices like motors, pumpsets, furnaces, stoves etc. In this maze of organisations and agencies there is no integrated approach to energy planning. People calculate growth rates for each fuel and project it for many years. Then they look around for additional supplies* to meet these projected demandemands This supply and demand based "planning" is done for each individual energy form. Because of this lack of coordination and the total absence of an integrated approach to energy planning we get many situations,of wasteful energy use. Mr.S.G.Ramachandra, an eminent energy specialist, estimates that the energy consumed by individual

household pumps to lift water from .a sumpwell to an overhead tank in Bangalore city is nearly twice that used by the water supply board (BWSSB). Thus, proper availability of supply of power to BWSSB and well maintained pumping heads, can very easily reduce this wasteful energy consumption by individual households.

Despite all the additions to the generation of electricity from newer power " plants there continues to be a shortfall between demand and supply. And this deficit is projected to continue and even increase for many years to come! Thus power cuts have become and Shall remain a way of life. Industries use captive diesel sets to generate electricity in their own premises in order to meet their demands. During a survey we found that in Karnataka the industries sampled by us produced about 40% of their electrical energy from diesel sets.

Thus, any deficit in one form of energy (e.g. electricity) leads to substitution by another form (e.g. diesel). This substitution has reached enormous proportions that today not only industries but even shops and households are buying diesel generator sets. Hospitals, computer centres and other similar institutions are forced to own their own uninterrupted power supply to run their equipment. The cost of power supply is of ten more than the cost of the equipment. This situation coupled with the disappearance of forests, wood-lots and roadside trees is conclusive proof if any proof were needed of the absurdity of our energy planning.

Whenever we convert energy from one form to another, the full energy content is not converted into useful form; some energy is invariably lost. In other, words, no device can be 100% efficient. This fact illuminates another facet of the energy planning problem. There ought to be minimum conversions of energy between different forms since each conversion implies waste. Energy sources need to be well matched to end uses. For example, electricity is a very high quality energy whereas agrowaste or dung are of lower quality. End uses can be categorized according to then quality requirements. At the' lower end is low temperature heating (bath water). Next in ascending order are cooking, high temperature heating, metallurgical furnaces, very high temperature heating, lighting, movement, electrochemical activities, etc. We have tried to maximise the efficiency of many different sources like biogas, firewood, solar energy, electricity, kerosene by properly matching them to various end uses like cooking, lighting, irrigation, transport, industries, etc. The model gives us a plan for use of each type of resource and an optimal path. For example the plan suggested use of electricity for lighting instead of kerosene. The study showed that the optimal path resulted in an order of magnitude (a factor of ten) reduction in the energy costs per household.

An ideal energy planning strategy ought to have the following objectives:

i. Maximize energy conservation,
ii. Optimize energy source - end use matching.
iii. Maximize use of renewable resources.
iv. Penalize use of depletable resources.
v. Maximize production of renewable resources like biomass.

Users of energy are very diverse ranging from individual families to commercial units, small industries, transportation systems and **large** industrial complexes. Hence any reduction in energy use and the consequent **increase** in efficiency requires very' **strong** motivation amongst many. Actually, in our social system we have disincentives. 'A major disincentive is the price of energy. Our energy is heavily subsidised. Large subsidies result in a wasteful consumption of energy. Curious situations obtain. A dichotomy can be seen from the following example: whenever an electricity board increases the tarriff, the industries, and their representative organisations voice a very strong protest saying that the costs of their products will increase and they should **get** subsidised energy. (This despite the fact

that an many industries the cost of energy! is less than 10% of the cost of production.) But, on the other hand, whenever there is a power cut, these industries have happily switched over to captive diesel generation unmindful of the fact that the cost of electricity from such sets works up to about two Rupees per unit compared to the cost of grid electricity at around 40-60 paise per unit. (Until recently the cost of grid electricity was five paise per unit for industrial establishments.)

Let us now look at the following two questions:

. Are there sufficient savings available by energy conservation that we can aim for zero growth rate even though our per capita consumption is very low compared to industrialised countries?

ii. Is there sufficient potential of renewable energy sources so that we can look for meeting our energy needs from renewable energy sources only?'

Questions like does increase in energy consumption lead to development etc. 'are not discussed here.

Comparisons of Energy **Use**

We shall start looking at the first question by first defining certain parametres for comparison and then by comparing Karnataka's specific energy consumption with that of industrialised countries.

There are many indicators to compare lifestyles in various countries. Energy consumption plays an important role in indicating lifestyle. Initially energy consumption was compared with a country's gross domestic product (GDP). Later, energy consumption/capita was plotted against GDP/capita. It was found that there is a strong multi-country correlation existing between national output per capita and energy use per capita. Table I which gives the energy-output relationships for six industrialised countries and Karnataka state illustrates, that Karnataka has very low energy/capita and GDP/capita values. But these do not reveal the true state of energy use; what one would like to know is what is the level of efficiency? Normally it is said that since our energy use/capita is low compared to that of the 'advanced' countries we should increase our energy production so as tor reach the levels of the advanced countries. It is assumed that the energy/capita reflects the true state of the development of a country.

Country	GDP/Capita (dollars) Index	Energy Cons./ Capita (toe)	Energy/6DP ..... (toe)	Energy/6DP ..... toe/at
U.S.A.	5643	8.35	**1400** 1772 795	190 120 54
Canada	4728	8.38		
France	4168	3.31		
W.Germany	3991	4.12	1831	70
U.K.	,3401	3.91	1121	76
Japan	3423	2.90	849	57
Karnataka *?4-*75	696.05 (Rupees)	0.444		493
Karnataka '79-'88	728.8 (Rupees)	0.492	8893	547

Table I : Energy/Output Relationships
toe/ $: tonnes of oil equivalent / million dollars

Recently there has been a shift" in thinking even in the industrialised nations. The important index is that which reflects the efficiency of energy use. This index is not energy/capita but rather energy/GDP This is given in column 4 of table I in absolute terms and in column 5 of table I in relative terms compared to U.S. as standard.One finds that Karnataka is using five times more energy compared to U.S. for producing the same output. The-comparison with France or Japan is even worse. Two points need to be mentioned about this table. First, it does not include human or animal energy. Our society uses more of these forms of energy. Secondly, most of these countries require a large amount of energy for space heating during winters due to unfavourable weather conditions We are fortunate in having an warme

climate and require little space heating. If adjustment is made for both these factors, then the energy/GDP index for Karnataka becomes even more unfavourable.

Next, we take a closer look at industrial energy consumption. Table II is a comparison of industrial energy/, industrial GDP figures of different countries and Karnataka. One finds that in karnataka, industry is consuming 8.8 times the energy by U.S. industry for the same output. This definitely reveals the enormous possibilities of improving energy conservation in our industries.

Country	toe/es Industrial 6DP	Index	Electricity as a *X* of energy in Industries
USA	1427.7	108	17.3
Canada	1777.2	124	21.8
France	574	48	15.1
W.5eraan	736.6	52	16.0
y	1146.1	98	'4.8
U.K.	924.t.	65	20.0
Japan	12615	884	
Karnataka 74-75	8105	568	69.0
Karnataka			

Table IhEnergy Consueption in the Industrial Sector
All prices adjusted to 1972
toe/a s:tonnes of oil equivalent aillion dollars

Column 3 in table II is the quantum of energy consumed by industries as a percentage of total industrial energy. We find that despite power cuts for the past many years the share of electricity in Karnataka's -industrial cake is much higher than what obtains in industrially advanced countries. Electricity - a very high quality source - is being used for lot of low or medium temperature heating by industries in Karnataka. This wasteful application is taking place not. because electricity is efficient, but because it is convenient and has been priced to be cheaper than other fuels. The comparisons of table II were done for the year 197)2 - before the start of the oil crisis. Since 1973 many of these countries have gone in for energy conservation in a big way.

Detailed studies have been done regarding specific energy consumption - energy required to produce one unit of an item. .These studies have been done on various industries like engineering, chemical, metallurgical, paper, textile, sugar,etc. These studies cover a period of many years. Two interesting points emerge. First, there are large differences in energy consumption per unit of production within each sector. Thus, one paper unit uses 17245 units/unit of production whereas anotjher manages to make do using 12510. Similarly in textiles the values range from 5345 to 8102. Secondly, observed over a period of five years from 1979 to 1984 many industries have become progressively more inefficient. In 1984 for example, the heavy engineering industry was using more than one and a half times the energy to produce the same amount of goods that it did in 1979.

From all this we are led to a conclusion that there is a very large potential for energy conservation I in Karnataka. It is good to recall he an estimate of the National Productivity Council that we can reduce our consumption very easily by 25% | by incorporation os simple inexpensive strategies in our energy use.

Renewable Energy Resouroes of Karnataka

Having set the stage by first looking back at our energy consumption strategies and then at possible improvements in the efficiencies of use, let us now consider the second question. How do we meet our additional demands) , if any? Are there enough renewable energy resources to meet this? !

The first point that we ' should clarify here is that many of us' confuse energy with electricity. Even a cursory

look at Karnataka's energy scene would tell us that electricity accounts for less than 20% of the total energy consumption. Even amongst commercial **energy** sources electricity cones second after oil.

Source	Potential/Year (MKW-Hours)
Agricultural residues	**50,000**
Biogas (Animals)	11.790
Biogas (Sewage)	500
Maior Hvdro	14.500
Microhvdel on Canals	800 - 3200
Microhvdel on Streams	Not Known
Solar	5000 -10000
Wind	40,000

Table III Potential of Renewable Energy Sources in Karnataka

Table III gives the available potential/year for renewable energy sources in Karnataka. The present annual energy consumption in Karnataka is around 35,000 million units. We see from the table that this requirement can very easily be met from the renewable resources. Actually the potential available is quite large compared to the requirements.

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Global Warming Threatens Nuolear Plants

According to an article in the British Journal **The Ecologist,** nuclear power plants situated mostly in low level coastal sites in many countries are likely to be inundated by the rise in sea levels as a result of global warming caused by the greenhouse effect. Sizewell and Bradwe11 stations, located in East Anglia in the UK are especially at risk. In 1953, sea levels **there** had risen by up to four, metres, producing widespread flooding. Sea levels in East Anglia are rising twice as fast as the global average due to subsidence. Flood emergency plans do not specifically cover nuclear plants.

Storm surges powerful enough to knock out a nuclear plant's auxiliary power systems could, in the extreme, cause several major system failures at once. In the case of a defuelled reactor (in the early stages of decommissioning), flooding could cause the release of radionuclides from less well protected facilities. Seawater would cause corrosion of concrete structures. Even without flooding, raised sea levels could raise water table levels and lead to the intrusion of saline groundwaters, which could then attack the concrete base of a reactor's containment building releasing radionuclides into water resources inland.

Although somo precautions are being taken at coastal sites in UK, the East Anglia sites are especially poorly defended. At Sizewell, dunes are being reinforced to a height of ten metres above the sea level - but the 1953 surges would have reached nearly half this height and given their force,could have breached them. By the time the decommissioning of Sizewell B is due to be completed in the early 22nd century, sea levels are predicted to have risen by up to two metres. This figure does not take into account the melting of the West Antarctic ice. It is obvious that the risk to reactors from flooding and damage from surges- and saline groundwater intrusion will increase considerably.

The cost of adequate sea defenses and other on-site measures which might reduce (though not necessarily prevent) the risks to a nuclear plant over the 130 years of its operation and decommissioning, would add enormously to nuclear costs. But anyway there is no evidence that such considerations have been taken seriously in siting policy by any nuclear authority anywhere.

Source: WISE News Communique 311.3105

Editor's NoterTarapur and Kalpakkam are already built and in operation. Urgent safety measures need to be taken to help reduce risk there. However, it is, downright foolhardy to plan further coastal constructions without taking greenhouse effect into consideration. Jaitpur and Koodankulam take note.

Disorder In The Deep

The Rational Idea

The ecosystem is composed of the natural , interwoven, ecological cycles and provides all the resources that support human life and- activity. The production system is the man made net-work of labour processes and technology that converts the resources into goods and services - the real wealth that sustains society, the economic system is the recipient of this wealth and governs the manner in which it is distributed to the members of the society

Energy flows within and between the three systems play a leading role in integrating them together. The quantum, the quality and the pattern of these energy flows greatly condition the nature of the interaction between the systems. It is logical to .expect the economic system to confirm to the requirements of the production system **and** the latter to the requirements of the ecosystem. Anyway, that is the rational idea. With this logic in mind let us look at the marine fisheries sector in Kerala.

The Low Energy Sector

In Kerala, the marine ecosystem is blessed with nature's bounty of a high quantum of stored solar energy in the form of fish. It is assessed that the annual sustainable, free flow from this ecosystem is a little over 30 tonnes of fish per square kilometre of coastal sea area - or an equivalent of about 720 million kilo calories of energy. The potential in other parts of India is only between one half to one third this level. Kerala's coastal area measures 12570 square kilometres and this places the maximum sustainable yield (MSY) per annum around. 380,000 tonnes of fish.

This potential of stored energy was initially converted into a resource by a traditional community of fisherfolk who lived by the sea and laboured on it. They used low energy, low entropy production system with artefacts manufactured and operated using renewable sources of energy. The resource was in turn converted into wealth through an economic system which was **also** low in energy Use and largely dependent on solar and human energy.

This scenario was a familiar scene in Kerala as recently as a decade ago. Fishermen on elegant, sail-powered canoes laden with a catch of fish heading for the shore. The waiting fish distributors women and men - who moved the fish to neighbouring markets carrying it in baskets on their heads or the back of bicycles. They took the fish to the market in the fresh state or after drying it in the Sun. .

These were the concrete expressions of the low energy consuming but highly efficient' chain of interaction between the ecosystem, the production system and the economic system. The methods of fishing were "passive and selective". They caught fish without disrupting the ecosystem, the fish catch per fisherman was low - well within the sustainability of the ecosystem. The price of fish was low and hence incomes were meagre. The level of disparity between participants in this economy was also low. The fishery was largely dependent on other local and national sectors of the economy for supply of inputs (wood for crafts; cotton for nets; rice, tapioca and other provisions for food; clothes etc.) and market for Its fish - the bulk of which rarely moved to markets beyond 20 - 50 kms. of the landing centre.

This was by no means a Utopia. There was exploitation. Lack of basic necessities and amenities for a full human existence were well apparent. Fisherfolk were however in full command of the production process.. Nature was not an entity outside their frame of life. The Sea was the Mother and they were her children. They well understood the ecosystem with which they interacted

and possessed a pragmatic and holistic perception of it. The production system and the ecosystem were in harmony. The economic system, though limited in its spatial extension was however outside their control. They did not perceive it to be overexploitative and were hardly prepared to change it through collective action.

The High Energy Seotor

A new pattern of fisheries development undertaken at the initiative of the state, but driven primarily by the international market forces, was imposed upon such an economy.

On land it was possible to intervene in the ecosystem to raise its productivity by using energy additives (fertilisers) or energy aggregators (greenhouses). Such options at sea were limited. There was a fallacious yet strongly held , belief that sea was an inexhaustable biomass of fish. This provided the rationale for an excessive concentration on introducing technologies in the - production system for **harvesting** the sea more effectivly. Moreover, since the sea was considered a "free for all' terrain - a common property resource - this seemed the most sensible option available.

A big leap in the harvesting power of the fishing units resulted. Crafts powered by renewable energy sources and employing a range of passive and selective fishing gear were set aside. Instead mechanised grafts with single, active and non-selective fishing gear were preferred. Trawlers and purse seiners are two examples of these craft types used for fish harvesting under this new "planned fisheries development" regime.

There is one important dimension about these two sea harvesting artefacts which rarely gets highlighted. They were invented for an ecosystem (temperate zone sea) with a totally different energy configuration compared to the ecosystem (tropical sea) into which they were introduced.; Like any other exotic, **they were prima facie unsuitable in** uncontrolled numbers.

In the activities of processing and marketing, new technologies were introduced that resulted in a quantum jump in non-renewable energy use. Freezing, canning and the use of ice for preservation expanded the shelf life of the fish and thus immediately opened up possibilities of long distance marketing. This in turn became feasible only with the use of fossil fuel powered transport like insulated vans, refrigerated railway wagons and cargo ships.

The new energy and capital intensive technologies initially increased the labour productivity. It became possible to "dominate" and "exploit" Nature with them. The harvest of fish was soon above the desired levels of sustainability. The value of the output increased sharply consequent to the export orientation of the harvest from the sea. The incomes of those who utilised these technologies also increased. (In Kerala only between 10% - 15% of the fishermen work on mechanised boats.) Disparities between the owners of the new artefacts and the rest also widened. The dependence of the local fishery on the national and the international economy became greater both for the supply of inputs and as a market for outputs. The active disruption of the, marine ecosystem was on the increase: trawling resulted in indiscriminate damage of the aquatic milieu and purse seining overfished to the point, of species genocide.

The High Entropy Scenario

Until 1969 the fish catch in Kerala was below the annual mean sustainable yield (MSY) of 380,000 tonne. This harvest was made exclusively in the coastal waters and 95% of it by the traditional fishermen using 24,000 non-mechanised crafts. My rough estimate 'is that for every unit of energy input into the production process (the metabolic energy equivalent of the labour of the fishermen measured in Koal.) the output was between 40 to 80 units. (The energy in Koal. from fish.)

Between 1971 and 1974 the fish harvest rose above the MSY. It averqaged 400,000 tonnes and rose to 448,000 tonnes in 1973. The mechanised boats - now

predominantly trawlers - accounted for *23%* of the fish harvested in 1974. Their harvest was composed of prawns and large quantities of bottom dwelling species of fish caught along with it. This spurt in the harvest of prawns came as a result of consumers in developed countries with high energy luxury diets exercising their power on the economic system. Prawn prices on the seashores of Kerala increased from Rs.10,000/tonne in 1970 to Rs.20,000/tonne in 1975. The common property character of the sea, the encouragement by the state and the big profits to be earned from the "pink gold" resulted in an influx of trawlers owned almost wholly by non-fishermen. The trawler fleet increased from • around 700 in 1969 to over 2400 by 1975. An important energy issue which also had a strong influence in creating this situation was the rather low prices of petroleum products. The HP ratings of the engines used in the mechanised boats were also significanly above their necessary requirements. But a more powerful trawler could rake up the bottom of the soa more effectively thus enhancing the share of the prawns in every haul of the trawl net.Tho disorder and the damage this created in the sea bottom was considerable. Nature was wounded, but then Nature never reacts to her wounds immediately, and when she does, it is not always those .who cause the harm who suffer the most!

After 1975 the total fish harvest in Korala began to register a decline. Prawn harvest also dropped significantly. In 1980 the fish catch was as low as 280,000 tonnes - the lowest since 1963! Prawn production dropped from the peak of 77,000 tonnes in 1975 to 30,000 tonnes in 1980. The price of prawns however, continued to soar reaching a new height of Rs.46,000/tonne in 1980. Despite this overall decline in the fish harvests, the catches made by the trawlers actually registered an increase, implying that it was a large number of traditional fishermen who suffered the most..

So, despite increased fuel prices after 1973, enhanced investment costs and rising running expenditure, the number of trawlers in Kerala continued to rise. In 1902 it had crossed the 3200 mark. Energy balance too became increasingly adverse. While several traditional non-mechanised fishing techniques maintained a ratio of output to input energy between 20 to 60, similar analysis in the case of trawlers gave a figure of 0.5 -a negative balance!

	Low Energy Sector		**High Energy Sector**	
Year	**Productivity Kg/Year**	**Income* (Rs.)**	Productivity Kg/Year	Income* (Rs.)
1961	**3540**	**330**	**NA**	**NA**
1965	**3820**	**380**	**NA**	***NA***
1969/70	**3340**	**630**	**5150**	**790**
1974	**3200**	**870**	**10040**	**5060**
1979/80	**1780**	**540**	**7540**	**2630**
1982	**1620**	**420**	**7700**	**1560**

* Income adjusted to 1960-61 prices

Table I Estimates of Productivity and Real Incomes of Fishermen in the Low and High Energy Sectors of Kerala's Fish Economy.

Tht fealty Front

The increased energy use and the high levels of disorder created very significant disparities: (i) that between fishermen using renewable energy technologies and those using mechanised crafts; (ii) that between fishermen workers as a whole and the class of owners of mechanised crafts Who were all non-fisherfolk.

In table 1 we see that between the years 1961 and 1982, the physical productivity as well as the real income of the fishworkers within the two sectors, first rose and then dec lined. The incomes and the productivity levels of the high energy sector were generally significantly higher than that of the low energy sector. However, the rate of decline of the incomes in the high energy sector is more rapid although the converse is true with physical productivity

Beating Entropy and Inequality with More Energy?

The disparities that arose as a consequence of the high energy, high entropy state of Kerala's fish economy gave rise to two important responses on the part of the fishworkers. The first is by now well known: The militant unionisation of traditional fishworkers. The greatest achivement of this "blue political movement" was its ability to extract a reaffirmation from the state that the exclusive access to the coastal waters was indeed their traditional and historical right.

There is however a lesser known response. From our perspective it is the more important. This has to do with the initially slow - and - cautious but subsequent tidal-wave-like shift towards using outboard motors on traditional crafts. In my opinion' this . trend frittered away the gains achieved by the political movement.

In 1980 the first commercially marketed outboard engines were sold to fishermen in the central regions of Kerala.By 1982 the number of motors used on traditional crafs in the whole of Kerala was around 2,000. By mid-1988 it was estimated ' that over 75% of the active fishermen were using the now ubiquitous outboard motor. We have here a revolutionary change in the technology configuration, a drastic change in the composition of energy use. and the energy balance. This was coupled with a concomitant rise in costs.

Fishermen have been caught on the one, hand in an upward increasing spiral of rising HP ratings on their engines, increased investments in their fishing gear and higher energy costs. On the other hand, it has been a downward spiral in relation to the fish harvests. They have 'lost their earlier knowledge and the control over the production process, virtually handing it over to multi-national corporations. Harmony has been ruined. Armed with mechanised power they also began to use more active and non-selective fishing gear which for all practical purposes were merely smaller versions of the destructive purse-seine nets used by the larger mechanised vessels.

In order to beat the entropy crisis the fishermen have sought to expand' life beyond the radius of tradition by a total shift from metabolic and renewable energy to a state of almost exclusive dependence on non-renewable energy and mechanical power. Fishermen, who less than a decade ago were the best sailors have stopped using sails altogether. Rowing is ofcourse totally out of the question. Enslavement to the outboard engines is by now almost total. More such gadgets await their turn in the pipeline. The multi-nationals which market these artefacts have acquired the ability to create and shape the basic needs of the working fisherman .into something which the multi-national alone can satisfy The hold of the multinationals on the labour power and the labour process of the fisherfolk is complete.

An inquiry into a cross section of the fishermen has revealed that in their opinion the most important feature of using the outboard motor was the reduction in the drudgery and the physical strain of their work. Surely this is an important and laudable goal to be achieved? The- real question that needs to be asked however is, whether this

reduction in drudgery has resulted in a greater range of fishing operations, higher incomes, more comfort, less alienation and enhanced sustainability.

The evidence now being gathered points to a situation where the above list of desirables is hardly visible on the horizon of the vast majority of the fishermen in Kerala today. In dust eight years they are bonded to an economic system which determines both their choice of technology and the prices of the product of their labour. There seems to be no possibility of going back to a more sensible energy balance. They are caught in a downward vicious spiral. This is forcing them to ruin the ecosystem on which their long term future depends. It is on this score that Kerala's fishermen can be said to have won a battle but lost the war.

Dr. John Kurien
Institute for Development Studies
Trivandrum, Kerala

LETTERBOX

As far back as 1953, the Swedish Fuel Commission in a preliminary report initiated a move to put a break on the over-dependence on non-renewable energy resources like oil and instead advocated active energy saving measures by way of encouraging insulation of dwellings, developing wind power machines and solar domestic heating systems. But by the time the commission submitted its final report in 1956 its enthusiasm had evaporated. The industrial mandarins had managed to hijack attention to nuclear power as an omnipotent and everlasting alternative to oil.

Godfrey Boyle has remarked that non-renewable energy sources have a unique characteristic eminently suitable for exploitation by the ruling oligarchies for the furtherance of their interest and hegemony. Fossil fuels are accumulated.. in specific locations and thus can be easily appropriated by them. Renewable energy sources have an egalitarian . Character being pretty evenly, distributed around the world. Their low concentration prevents easy exploitation

According to Ralph Nader, and John Abbots, the inexhaustable source of solar energy was, to the power holders, "an ugly duckling whose eggs were never to be hatched." Since solar energy resources can be provided at individual dwelling sites, they are under the individual's control and management and hence beyond the control of utilities or governments. Since the 1950s fossil fuel stocks have started dwindling at an ever increasing rate. Uranium has managed to fit into this existing politico-engineering framework to cater to the hegemonistic world view of the powerful.

Kamaruzzaman
C/o Andhra Bank
P.O. Durgapur 713213
W.Bengal

The struggle for housing - for a place to live in security and dignity - is one of the most basic (if unrecognised) struggles that all- people are engaged in. It is in terms of this struggle that people at a mass level can be made concerned about and involved in, the intense and ultimate contradiction to life that nuclearisation represents.

Nuclearisation inherently increases the level of hazard in our environment and therefore intrinsically contradicts the right of every woman, man and child to live in security and dignity. There is therefore an undeniable need for those of us interested in the right to housing, to very critically assess the situation, so as to intervene effectively in the public interest.

It is our belief that people, in general do not and will not become concerned with abstract questions of environmental risk'. Such questions' will only concern them if it is related to what they do in ordinary life. Housing is one such activity - basic, continuous, unrelenting, unrecognised but known intimately to all ordinary people. It has tremendous potential as an entry point and as a point of integration and insight.

Finally, we are working on the hypothesis that nuclearisation today has been successfully made almost a patriotic

goal. To question it, bring a reflex reaction not about the merits of the argument but about the motives of the questioner. Therefore, we feel that it is first necessary to marshall and put forward information and to use such information actively and purposefully.

Miloon Kothari
National Campaign for Housing Rights
21 Hauz Khas Enclave
New Delhi 110019

Shri Laxmi Narain Modi, Director, Nation Building Forum has sent us copies of his interesting correspondence with the authorities on matters relating to nuclear power plants. We will continue to Pablish excerpts from these letters. Asking the government to justify its policy is an important means of demonstrating public awareness.

"Recently, the proposal to store hazardous chemicals atop Antop Hills near Bombay has been rejected by the expert committee appointed under the directions of the "Supreme Court. The Honable Court stated:
"The fundamental right to live also includes the right to a clean environment."

There are many reports that even while the atomic plants are operating normally, they do cause lot of environmental disturbances.* Under the newly enacted Factories Act, it is the responsibility of the management to give full, information not only to the workers but! also to the people in the vicinity about the dangers involved but regretfully no such information is being given by the DAE. There is more of concealment than disclosures of correct information.

Even with regard to the economics, nuclear power plants would not be economic when it is clear that their life is only about 25 years whereas radioactive wastes are a threat for thousands of years. It is therefore important, that before any atomic power plants are made critical, there should be satisfactory plans for waste storage ana true details of the costs should be known to the public. Otherwise there is no advantage in going in for such high investment technologies."

Laxmi Narain Modi
National Building Forum
C-38, Pamposh Enclave
New Delhi 110048

Cycling Out **of the Greenhouse**

A report by Ian Grayson for Friends of Earth - Australia, reminds us of the role played by the transport sector in causing the greenhouse effect. A switch in transport priorities by the industrialised world to bicycles and public transport would reduce the greenhouse threat substantially. Cars account for 17% of all atmospheric carbon dioxide released by fossil fuels.
Source:WISE News Communique 304

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ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Volume 2 Number 5 **April 1989**

"What happens in the Pacific *is* usually
told from the oppressor's point of view,
because we don't have access; to write our
stories., we don't have access to
resources to travel, we're, not recognised
as a people that should be talking about
what really happens to us."

Titewhai Harawira

Talking about human rights is 'in'; especially for governments. Taking concrete steps to protect the rights of the weak and the dispossessed is not so in especially if there is clash with perceived military interests.

This year we celebrate the two hundredth anniversary of the French Revolution. That revolt of the poor and the downtrodden which established human rights as an. article of state policy. A revolt which forced all governments ever since to derive their legitimacy not from divine- dispensation, but rather from the 'will' of the people. An inspiration to all who desire a more just and equitable world order.

The month of July also marks another, little noticed, anniversary; on July 2nd 1966 France exploded its first nuclear bomb in the Pacific. Despite worldwide condemnation the French government has continued exploding its bombs ever since. The latest of these tests, the third this year, was held on June 11th. Till today 145 nuclear explosions have already taken place on Moruroa and Fangataufa atolls. (41 in the atmosphere and 104 underground). Moruroa atoll is known to be sinking. Strong evidence links an increase in fish poisoning to French testing. Cancer statistics are marked "classified information" and are withheld by France.

Governments have come and governments have gone; the nuclear nightmare of the Pacific rolls on. For the past eight years, France has had a 'socialist' president. A person who was once himself a victim of Nazi persecution. One would expect that at least this administration would be more respectful of human rights ot others. But no, nuclear ambitions - ambitions which are ridiculous in the final analysis - reign supreme.

. In an earlier issue (Anumukti Vol.2 No.1) we have commented on the nuclear imperialism practised by the Americans in the Pacific. Their barbaric actions have brought disease, disability, dislocation and a loss of dignity and culture to a simple, peaceloving people.

The Pacific islands occupy a very special place in the collective conciousness of mankind. Their bountiful yet simple lifestyle has been a source of attraction and inspiration to many. Paintings of Paul Gauguin depict a world close to paradise. It is an obscenity that this paradise has been turned into a living hell by the inheritors of the French and American revolutions.

Celebrations of the revolt of the poor by the rich are a mockery of the revolution. It is only when all the exploited and oppressed peoples of the world, in Pacific and elsewhere, can live a life of dignity and self-respect that the French" Revolution would be truly celebrated.

Nobel Prize Nomination

Anumukti endorses the nomination of Belauan activist groups Ketal Reng and Otie A Beland for the Nobel Peace Prize 1989.

The determination and steadfast resolve of the people of Belau to retain the antinuclear provisions of the constitution of their island reprblic in face of massive US pressure, has been a shining example for all the people of the world. (See Anumukti Vol.2 No.1 for a detailed report) Indigenous people can take special pride in this struggle of right against might. Indigenous people everywhere as also the Adivasis of India have been special targets of policies which promote location of dangerous industries in the name of development.

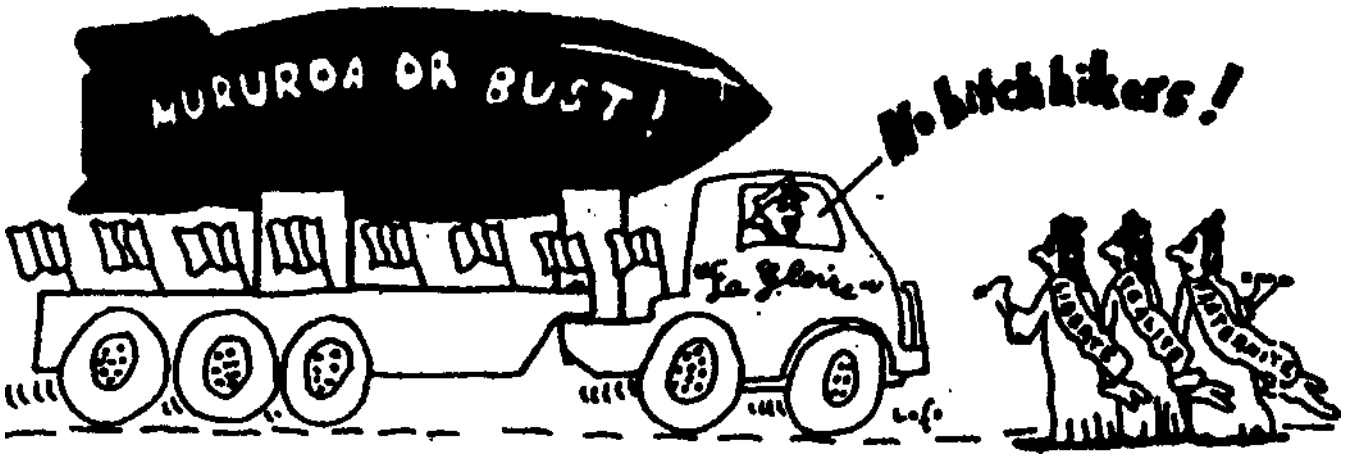
Nuclear Testing Kills in Surprising Ways

"Cignatera" is the name of a disease once rare in the Pacific. It results from the eating of a certain species of fish which inhabits coral reef waters Common symptoms of the disease are vomiting, diarrhoea, disturbances in balance and coordination and in severe cases death due to respiratory failure.

While the exact mechanism and the ecological pathways are still a matter of debate and further research, the culprit seems to be a certain species of plankton which is the fish's food. Nevertheless what is beyond dispute is the fact that wherever the reef ecology has been disturbed by nuclear detonations and military operations, -this form of food poisoning has increased rapidly.

Between 1960 and 1984, the annual incidence of Cignatera poisoning rose tenfold in French Polynesia, peaking in the early 1970's at 12 per 100 inhabitants. On Hao atoll in the Tuamoto Islands, Cignatera was unknown before 1965 The (disease first occured one year after the French used the island as a base for their tests at Moruroa and Fangataufa. By mid-1968, it had affected 43% of the islands 650 inhabitants.

Source: WISE News Communique:309



"For The Good Of Mankind"

Gigantho stone statues with long ears and expressionist faces stare solemnly at visitors to Rapa Nui, known to the world as Easter Island because a European ship "discovered" it on an Easter Sunday. The island is perhaps one of the lone.'liest places on the globe. It has attraoted scholars due to its strange archaeology. Today, Rapa Nui is one of the emergency landing sites of the US space shuttle programme.-

Elusive Peace

The Pacific: covers nearly one third of the eart;h's: surface. Its waves play on the shores of some of the most economicaljy and militarily powerful nations. Heavy battles were fought here during World War II. Ever since, despite its name, the Pacific region has never returned to a peaceful state.

The Polynesian queen of Hawaii was overthrown by the U.S.A. in 1893. It is today the 50th state of the U.S. with 110 military installations, control facilities for conducting nuclear wars and nuclear arms bases. Micronesia, after experiencing frequent change of colonial 'masters' was finally given to the U.S.A. as a strategic trust territory by the United Nations Security Council. The trusteeship agreement required the US government to " promote the development of the inhabitants towards self government and independence against the loss of their land and resources". However, a year before this agreement the U.S. had already detonated nuclear bombs on the Bikini atoll in the Marshall Islands. The people of Bikini were told, " We are testing these bombs for the good: of mankind, and to end all wars". They agreed to being moved away from their island " for a short time" and were consequently relocated on an uninhabited island. When the U.S. navy remembered them a year later, they found them starving on the infertile island. So, they were relocated another time. Today U.S.A. is in the process of releasing Micronesia into something less than complete independence. It want; to keep the right to use the islands for its own purposes but at the same time does not want to grant the- islanders U.S. citizenship. Only Belau, perhaps the most important pawn on the American strategic chessboard, poses an obstacle. Its people have time and again rejected Washington's blandishments and have.reaffirmed their support for the anti-nuclear provisions of the constitution. (See Anumukti Vol.2 No.l August '88)

"Three years later the people of Kongelap were allowed to return to their island despite 'lingering.' radioactivity. Included in these returning to Rongelap were-200 people who had been away from the atoll during the "Bravo" and subsequent tests, an ideal 'control' population for the study of the long term effects of the lingering radiation on the islands". The controls' began showing signs of radiation induced diseases years later, after living on their radioactive islands and eating the radioactive food and water. The people who returned to Utirik, ".50 miles further away, began developing thyroid dislase and cancers equal to the rates of the more heavily exposed Rongelap people twenty years later, giving evidence of the effects of even low-level radiation on human health. The 'guinea pigs' were indeed doing their jobs."

The Nuclear Fix

Islands of Love

The southern part of the Pacific is French Polynesia; an area comprising of about 400 inhabited islands suffering the consequences of the nuclear ambition; of another Western "power". Known in Europe as. "Islands of Love", Polynesia have inspired dreams amongst many among them

Paul Gauguin, Herman Melville and Thor Reyerdahl.

This dream world was shattered in 1968, by the French decision to start nuclear testing on Moruroa and Fangataufa Atolls. The ruthlessness and the priorities of the French were demonstrated in the very first year itself. A test which was to be conducted in the august presence of President De Gaulle was not cancelled despite winds blowing towards populated areas. After all the French President was a busy man and could not be expected to change his busy schedule just because of an adverse wind!

France despite the Test-Ban-Treaty of 1963 continued atmospheric testing in the Pacific until 1975. These included a long series of unsuccessful attempts to discover the -nechanism by which hydrogen bombs are triggered off. After 1375 Moruroa has been subjeced to an unfinished series of underground blasts. These have damaged the geological structure of the island beyond repair. There are rumours that France is now looking for another site to continue its bomb testing programme. A site often mentioned its Kerguelen Islands in the Indian Ocean.

Powerful Links

France is the country with the most 'successful' nuclear programme. About 70% of its electricity, more than that of any other nation, is produced in nuclear power plants. However, in terms, of profits, the programme has beer, a dismal failure. The state run electri city "board" Electricite' du France- has a debt rivalling that of big Latin American debtor nations. The programme for increased nuclear power generation proceeds i*n* spite of all this. The strong links between the "peaceful" and the military uses of the atom are the 'motivating factor. Hiding this connection far away in the French colonial 'possess-ions on the other side of the globe is so effective that even the peace movement, in France does not show much.concern for the happenings- in Polynesia.

Other countries too, have used the Pacific for their war games. Britain conducted six atmospheric tests on Christmas Island in 1357 and 1958. At that time many people from Kiribati, today an independent republic, were present on the island to work on copra. As the British have refused to trace the people who were exposed to radiation, the government of Kiribati is now doing its own health surveys with very limited resources. Other British tests were conducted on aboriginal land in Australia, mostly in a sloppy manner.

Soviet military presence is limited to the northern Pacific, close to its own coast. However, the Pacific has been used for missile testing by both USSR as well as China.

"And I have had seven miscarriages and stillbirths. Altogether there are eight other women on the island who have given birth to babies that look like blobs of jelly. Some of these things we carry for eight months, nine months. There are no legs, no arms, no head, no nothing. Other children are born who will, never recognise their own parents. They dust lie there with crooked arms and legs and never speak. Already we have had seven such children. Sometimes I feel that I have a baby inside me. I feel very happy that. I will have a baby, but then I an afraid what kind of baby it is going to be. I live in two separate kinds of worlds: one. part of me I want to have a baby, but this other part of me is scared to have a baby.

We have asked ourselves a question. Why, why has this happened? Every year the US Depertment of Energy doctors would come to Rongelap to examine people. They would tell us that everything was OK - that we didn't have anything to worry about. We told them that we didn't feel any betterand that our bodies felt weak all the time. We believe that the sickness is caused by the radiation from the Bravo test."

Lijon Eknilang

Living Laboratories

During the last forty years, the right to life and physical welfare of the people of the Pacific has been frequently abused. They have wilfully been experimented upon. The fate of the victims of the "Bravo" explosion of 1954 on Rongelap, Utirir and nine other **islands** is the best known amongst the **examples** of such "experiments'. (See **Anumukti** Vol.2 No.l or better still see. the film "Half-Life")

Though they lived 300 kms. from the test site, they began to feel the effects of the contamination on the very day of the blast. They were evacuated days later to Kwajelein navy base where soon they lost their hair, their finger-nails ----- ' Three years later they were told to return to their contaminated home. A spokesman of the Brookhaven National Laboratory said, "... the levels of activity are higher than those **found** in other inhabited locations. The habitation of these people on the **island** will offer most valuable ecological radiation data on human **beings."** Hers, the world of SCIENCE had a laboratory the like of which Hitler's concentration camp doctors could only **dream of,** Mueh of what we know about the effects of radiation on human health has been the result of research done on unsuspecting Pacific islanders. Darlene Keja-Johnson from Ebeye Island testifies: "They check their throat for thyroids. They also check their urine and their blood. If a person is found to have a cancerous thyroid that needs to be removed, they are sent to either US or Hawaii or Guam. They don't explain to you what they are going to do to your throat. They just say that you are to go...only the Department of Energy! people. go and meet them, but they don't speak Marshallese. They are told not to make any phone calls to any relatives or friends. They are told to speak only to Department of Energy people."

"Now Japan is deciding to dump their nuclear waste into the Marianas Trench. That has marie our islands so united that we are now much stronger. While some of us are still using kerosene lamps and candles, still fetching water from the well, in the US and Japan they have all the benefits of nuclear power. After all the nuclear bombs, now they are coming back with their nuclear waste.

Our only resources are the land and the ocean. We come to the ocean to relax. Our spirituality is the water, nature, the land, the stones. That's what keeps us alive today. We are a very simple people. Taking care of our families and our lands. Helping the poor. Helping the old people. We have no nursing homes for the aged - they are our books. They are our encyclopaedia. In our culture we have no written books. It is the old people who tell us our story, our tradition, from one generation to the next. They will be the ones teaching us to make rope, how to weave baskets. So, they are very important in our lives.

We are the people of the land and the ocean and we are struggling for survival. The ocean is our spirit. We come back, we sit down, we cry, we pray, we are still praying. Because our water is killing us, slowly."

Chailang Palacios

Growing Opposition

The success of the protest against French atmospheric testing in the seventies, has encouraged the people of the Pacific to continue their struggle against nuclear imperialism. The success was brought about by the cooperation of both non-governmental organisations like Greenpeace and the governments of countries like New Zealand, Peru and Fiji.The struggle promises to be both long and arduous. France meanwhile has, after switching to underground testing, taken to prosecuting the opposition in Polynesia and abroad. The criminal attack on the Greenpeace ship "Rainbow Warrior" in Aukland harbour in 1985 is just an example of this.

The independent nations of the Pacific, are trying to come to a unified position on nuclear testing and military

5

presence in the Pacific. U.S.A. has been engaged in trying to obstruct these efforts by exerting economic and military pressure. The Pentagon was "kinda delighted" that the coup made it again possible for U.S. nuclear ships to visit Fiji.

Ho **Compensation**

Nuclear blasts have made many an island uninhabitable for lakhs of years. The debris of the tests has either been thrown into lagoons or has been sealed into concrete domes. The first course recycles the waste into the food chain while the latter course just preserves the danger for future generations.

"Since 1971 only four Western nations have used the sea for radioactive disposal. The trend is away from this dangerous practice in light of scientific evidence. When we went to Japan, scientists spoke to us saying that one drum of nuclear waste dropped in the ocean can kill 215,000 to 30,000 people. We are only 13,000 people. We are aware of the fact that Japan has relied on current international law and the London Dumping Convention (LDC), in which we have no say, to defend its plan to dump nuclear waste. To us the LDC is a mistaken idea. Island governments are given no protection and no participation in this convention."

Maria Pangelinan

In 1977, the inhabitants of Rongelap and Utirik were offered a total sum of one million dollars as compensation. Compare this princely sum with the $13 nillion paid to the 24 crew members of a Japanese fishing vessel inadvertently caught in the danger zone of the same test. People of Bhopal would not be surprised by these American double standards!

The French government, as per previous contract, will not be liable to pay **any** compensation or reparations for the damage caused, when it eventually returns Moruroa and Fangataufa to 'the people of Polynesia

Nuclear Waste Bin

As if feeling that this nightmare should never end, several industrialised nations with Japan and U.S.A. in the frontline, plan to use the Pacific as a dump for the waste from their nuclear power plants.

In 1985 the London Dumping Convention, a UN body which sets voluntary guidelines for dumping toxic substances at sea, discussed the dumping of nuclear waste. Spain proposed an indefinite moratorium on nuclear dumping at sea. Activists of the Northern Marianas Committee Against Nuclear Waste Dumping had collected the signatures of nearly 100% of the population against nuclear dumping. Being a colony, they were officially represented by the greatest democracy USA, which opposed the Spanish proposal.

Recently, the issue has cropped up again with a new urgency. Yucca Mountain Nevada has been designated as the site for a high level waste repository. There is local opposition to choice of this site. In case tests prove the site to be unsuitable there is a good chance that Marshall Islands would be . selected instead. Some local politicians have already offered it for a little money in exchange.

Disposing nuclear waste in the Pacific has seemed more and more attractive as protests against disposal of wastes from nuclear power plants grow in the industrialised world. Ecological awareness in the West has thus unknowingly contributed towards a new, aspect of nuclear imperialism in the Pacific.

Source*:

* Thijs de la Court, et.al. The Nuclear. Fix :WISE (1982)
* Frances Connelly, et.al. Pacific **Paradise - Nuclear Nightmare :CND (1987)**
* Women Working for a Nuclear Free and Independent Pacific, Pacific Women Speak Green Line (1987)
* Union Pacifiste Nos.250 & 253 (1989)
* **WISE News Communique No.310 (1989)**
* Indian Express 12.6.1989.

Deadly Companions

Nuclear Race In South Asia

As a result of recent West German Investigations into a series of illegal exports of sensitive nuclear technology, evidence is mounting that Doth India and Pakistan have even mor e extensive nuclear weapons research, development, and production programs than previously thought.

Since the leaders of both the countries appear unwilling or unable to constrain their nuclear weapons programmes, these countries remain in a nuclear standoff. A military crisis might compel them to deploy nuclear arsenals, and risk a nuclear confrontation in South Asia. And if either country tests a nuclear explosive, thy other will undoubtedly follow, unleashing a race for more sophisticated nuclear weapons, including thermonuclear weapons.

Pakistan

Pakistan ranks third, after Israel and Egypt, in the receipt of U.S. foreign aid. In November 1988, as a prerequisite for congressional approval of $231 million of military aid and $350 million of economic aid, President Reagan certified that Pakistan does not possess a nuclear explosive device. The standard, according to the Reagan administration, is, "whether Pakistan possesses a nuclear explosive device, not whether Pakistan is attempting to develop or has developed various relevant capacities." But with his certification, the president attached a letter to the Speaker of the House, indicating that the certification was far from easy. And Pakistan's current status may make it impossible for George Bush to make the same certification in 1989. .

Despite an earlier promise to the Reagan administration not to enrich uranium abovo 5 percent,., Pakistan is **Widely** believed to have been producing weapon'-grade uranium enriched over 90 **percent)** at its enrichment plant in Kahuta since 1986. Pakistan' s current -annual product ion rate of weapon-gracle uranium is. ' estimated to be .20-75 kilograms of weapon-grade uranium a year. At this: rate, Pakistan- will have produced 125-175 kilograms of weapon-grade uranium through 1988 atnd about 175-325 kilograms by the end of 1993. Pakistan's weapon program can build nuclear weapons requiring less - perhaps significantly less - than 20 kilograms of weapon-grade uranium each. Although the actual amount required depends on the skill and knowledge of the designers, at 20 kilograms per weapon Pakistan would have accumulated enough material to build six to eight nuclear bombs by the end of 1383 . Through 1990, Pakistan could have enough for 8-16 weapons.

Unrestricted Plutonium

For several years, reports have circulated that Pakistan is interested in building a reactor that would produce unrestricted plutonium. West German government sources recently revealed that during the mid-1980s Pakistan tried to acquire reactor components and technology from West German firms. According to a March 6, 1983, report in **Nuclear Fuel,** U.S. officials told the West German foreign ministry in 1986 or 1907 that "it is well known that Pakistan is developing an indigenous, unsafeguarded reactor," and advised German export officials to stop a German firm from supplying Pakistan with boron carbide, a neutron-absorbing material used in reactors.

Nuclear Fuel also reported that confessions of key suspects in the German investigation of illegal exports of nuclear 'technology and components to Pakistan by the West German firm NTG Nukleartechnik GmbH indicate that this firm supplied Pakistan with "know-how for desing and construction" of a "small pool-type" reactor.

Any plutonium produced in an unsafeguarded reactor could be extracted from the irradiated fuel in Pakistan' s small, unsafeguarded reprocessing facility, New Labs, near Islamabad; This

facility is reportedly capable of separating 10-20 kilograms of plutonium a year, but it is not known if the plant is operational or whether this annual capacity can be achieved.

Help from Chin

While Pakistan was developing the ability to produce the explosive materials, it was also learning how to design nuclear weapons. In 1984, Reagan administration officials asserted that Pakistan got design assistance from the People's Republic of China, although descriptions of the nature of this assistance *vary* greatly - from information about a crude nuclear device to a copy of the detailed design proven at China's fourth nuclear weapons test. According to Leonard Spector, the test involved the detonation of a warhead carried by a. missile, so if Pakistan received a copy of that design it has a warhead much smaller than a typical Chinese aerial bomb and able to operate under much more exacting conditions.

Whatever the nature of China's help, on its own Pakistan has tested the non-nuclear high-explosive triggering or implosion paclage for a nuclear weapon, according to Spector. Teste using a dummy core of natural or depleted uranium provide critical information about the imp Losion system. Pakistani scientists could evaluate the performance **0f** their design by using flash X-ray machines, which/take split-second photos of the warhead core during a test, or by using "pin-sensors" - electrical conducting pins placed within the core which measure the arrival times of the high-explosive shock wave. Because a spherically symmetrical explosion is required to compress the uranium in the core to supercritical mass, an accurate prediction of how the shock wave acts on the core would improve Pakistan's confidence that its design would perform as expected.

In an apparent attempt to build smaller nuclear weapons or to extend its existing stockpile of nuclear explosive materials, Pakistan has tried several times to import beryllium from West-Germany, and in a few cases succeeded. In 1987 Pakistan also tried unsuccessfully to obtain berylliam illegally from the United States.

* Both India and Pakistan have imported beryllium - a material useful in designing smaller, lighter, and more sophisticated nuclear weapons. India is also producing beryllium in its own facilities.

Beryllium is useful in the design of smaller, lighter, and more sophisticated nuclear weapons. The minimum amount of Plutonium or highly enriched uranium required to sustain a chain reaction, or "critical mass," can be reduced oy surrounding the core with a neutron, reflector, and beryllium is a particularly effective reflector.

Although a test might yield the political benefits of recognition as a nuclear power, Pakistan may be confident enough in its fission bomb design to feel that a full-scale nuclear test is not required. The design could be tested by conducting "aero-yield" tests, in which conventional explosives compress a small core of nuclear material, to produce a nuclear yield large enough to be monitored but still smaller than the blast from conventional explosives. If done carefully, zero-yield tests are virtually impossible to detect.

Tritium-booster

On January 29, 1989, the N**ew York Times** published the puzzling revelation that Pakistan had acquired a tritium purifying plant from West Germany to separate up to a few hundred grams of tritium "a year from other elements. According to **Nuclear Fuel's** reporter Mark Hibbs, the plant was shipped and assembled in stages between 1985 and 1987. About 0.8 gram of tritium was also sent along to test the plant's purification ability. Hibbs reported that the plant is located in a heavily guarded bunker at a military site about 150 kilometers south of Rawalpindi.

A few grams of. tritium, when mixed with roughly equal amounts of deuterium (readily available in such small quantities), placed inside a warhead can

"boost" the yield of the fission explosion several fold, allowing significant reductions in the size and Wight of a r.uclear weapon. (Initial loadings of taitium are not needed in thermonuclear weapons, because deuterium, in the form of lithium deuteride, can be used instead.)

* Pakistan has acquired sophisticated tritium processing equipment from West Germany, and India is building a plant that will be able to produce large amounts of tritium.

Since Pakistan is not known to have a large supply of impure tritium gas, the purification plant might have been intended as part of a complex of facilities dedicated to the production, extraction, and purification of tritium. Hibbs reported in February that Pakistan does not appear to have acquired the processing equipment necessary to separate tritium from the deuterium used as a coolant and moderator in its CANDU power reactor. According to him, it is possible that Pakistan might intend to produce tritium in an unsafeguarded reactor by irradiating lithium-6 targets. U.S. government officials say that Pakistan has tried to acquire lithium-6 and lithium production technology, although the outcome of its efforts is unknown.

Hibbs says that Pakistan intended to test its lithium target technology in the U.S.-supplied five-megawatt-thermal research reactor located in Rawalpindi by placing lithium rods inside neutron-absorbing control rods, which are inserted into the reactor to keep the nuclear reaction from going out of control. Although this reactor is inspected by the International Atomic Energy Agency, these inspections primarily monitor the highly enriched uranium fuel and are not designed to detect secret tritium production.

But even if it succeeds in obtaining tritium, Pakistan may not be able to develop tritium-boosted or thermonuclear weapons at the present time. _ Pakistan's acquisition of a tritium 'separation plant is difficult to understand, since its weapons program .is not thought to be sophisticated enough .o use this material now. Perhaps Pakistan is simply trying to mirror India's perceived capabilities, on-lead the world to worst-case speculation and the-impress ion that its weapon capabilities are more extensive than they are. "Bombs; seem bigger if they are ambiguous," says Theodore Taylor, who played a major role in developing boosted fission weapons. Alternatively, Pakistan might bo lookiig toward the future, and the tritium plant would be smother- indication that Islamabad is trying to improve its nuclear weapons capability in order to be ready to test more sophisticated devices, if it decides to start testing.

In Taylor's view, unless Pakistan has been given or was successful in. stealing a praven design, it is doubtful that Islamabad could develop reliable thermonuclear weapons or boosted fission weapons without conducting full- scale nuclear tests.

Delivering the Bombs

Pakistan has several aircraft capable of delivering nuclear weapons to Largest in India. Its most sophisticated aircraft are its 37 U.S.-supplied F-16 attack aircraft (It has been recently granted 60 more) and about 50 French-supplied Mirage-5 attack aircraft.

* Pakistan is reported to have Perfected the design of nuclear aerial bomb for its U.S.-supplied F-16 attack aircraft, and India has apparently been working on the design of a nuclear aerial bomb since 1984.

In January 1989, there were reports that Pakistan now has an aerial fission bomb that can be carried beneath its U.S. -supplied F'-16 attack aircraft. This report also stated that the detonation mechnism has been perfected and the bomb casing is suitable for high-speed flight. Progress has been made on developing an in-flight fusing mechanism, to prevent detonation until after release from the aircraft. Pakistan has also reportedly shifted from- "rapid-detonation. high explosive to high-meIting-point explosive

technology, which is widely used in U.S. nuclear weapons. This permits a reduction in the size of the warhead.

Pakistani army chief Gen.Mirza Beg announced in early February that Pakistan had successfully test-fired two short-range surface-to-surface missiles with ranges of 48 and 180 miles and with pay loads of about 500 kilograms each - large enough for a nuclear warhead. These missiles could be operational by the early l990s.

India

No one disputes India's ability to build Pissicr: bombs. It detonated a 12-kiloton "peaceful" nuclear explosive in the Rajasthan desert in 1974. Although some reports have stated that India has aetually built nuclear weapons, the Indian government consistently denies these reports and maintains that its official policy is not to build nuclear weapon..

Within a Few Weeks

In 1985 Prime Minister Rajiv Gandhi said repeatedly that India could acquire nuclear weapons at any time. In a **Le Monde** interview in June 1985 He said that India could become a nuclear power

* India probably decided several years ago to acquire the know-how to make a thernonuclear weapon (hydrogen bomb) as a hedge against Pakistan's growing atomic ability, and to be prepared to test such a device within a few months of a Pakistani nuclear test.

within a few weeks or months.

* India probably decided several years ago so acquire the know-how to make a thernonuelear weapon (hydrogen bomb) as a hedge against Pakistan's! growing atomic ability, and to be prepared to test such a device within a few months of a Pakistani nuclear test.

On August 8, 1985, India achieved the ability to produce unrestricted weapon-grade ' plutonium when it commissioned the unsafeguarded 100-megawatt Dhruva reactor at the Bhabha Atomic Research Centre (BARC), a large establishment employing about 14,000 people. India has also operated the 40-raegawatt Canadian-supplied Cirus reactor since the early 1960s, another reactor not subject to international safeguards, The plutonium from the Cirus reactor is. restricted to peaceful uses, which India

claims include "peaceful".nuclear tests;

The Dhruva reactor operated sporadically for three years, finally reaching full power in early 1988. According to India's Department of Atomic Energy's annual report for 1987-88, the Trombay reprocessing facility at BARC has been reprocessing Dhurva's spent fuel. When operating at full power, this reactor produces about 25 kilograms of weapon-grade plutonium a year, or enough for at least five nuclear weapons.

Comparable to China's Arsenal

In late 1985 or early 1986, India's reprocessing facility began separating plutonium from fuel irradiated in the unsafeguarded and unrestricted Mairas Atomic Power Project. The amount of Madras fuel reprocessed and the grade of the plutonium extracted is unknown, although Spector reported that India had recovered enough plutonium from Madras fuel for one to four nuclear fission weapons by the summer of 1986. Since then, the reprocessing facility has apparently continued to reprocess; spent fuel from the Madras reactors.

In all, by the end of 1988, India was estimated to have about 200 -250 kilograms of unsafeguarded plutoniur - enough for at least 40-50 nuclear weapons. During the next few years, this stockpile could increase at the rate of roughly 75 kilograms of weapon-grade plutonium, or enough for more than 15 new weapons, each year. If unchecked, India could create a stockpile of nuclear weapons by 1995 that would be comparable in number to China's nuclear weapons arsenal.

There is little reason to .doubt India's ability to design nuclear warheads small enough to be carried on aircraft and possibly on the missiles it is now developing. These efforts may have been helped by the import of almost .100 kilograms of beryllium from West Germany: in 1984 •• a supply large enough for dozens of nuclear weapons. At about the same time, India commissioned Its Beryllium Pilot Plant at New Bombay, which has produced…at. least kilogram quantities of beryllium.

India produces tritium for a wide

range of civilian applications, including light sources. India's current source of tritium, however, is not explained in the annual reports, although it probably comes from irradiating lithium in the Dhruva or Cirus reactors. India is also setting up a chemical exchange cum cryogenic distillation pilot plant at BARC to remove tritium from contaminated deuterium used in its research and power reactors.

Thermonuolear Weapon

A May 1935 West German intelligence document cited an unconfirmed report that the "leadership of the Bhabha Atomic Research Centre had been given the assignment by the Indian Defense Department, after consultation with the Prim© Minister, to continue working on the development of a thermonuclear weapon." Preparations were to be made so that "within two months of a Pakistani nuclear test, the second Indian test could be carried.out. Such an Indian test should simultaneously be used for the development of a fusion explosion." There is also indirect evidence of India's thermonuclear weapons programme. BARC has an extensive fusion energy research programme which could be of great help in designing thermonuclear weapons. In the mid-1980s, India's Department of Atomic Energy announced that it would develop an inertial confinement fusion process, using high-power lasers to implode tiny amounts of deuterium and tritium. According to the 1987-1988 annual report, one part of the lasers is nearing completion. Once finished, this laboratory-scale facility would provide India with a way to study high-energy density physics associated with a thermonuclear explosion, improve elaborate weapons design computer codes, and develop sophisticated diagnostic techniques and instrumentation.

Indian scientists have also sampled fallout from atmospheric nuclear weapons tests, a technique that may have provided India with useful data about both thermonuclear and sophisticated fission weapon designs. In 1980 Indian scientists sampled radioactive fallout from the twenty-fifth Chinese thermonuclear explosion "to obtain information on the test as well as on the levels of fallout at countrywide monitoring stations."

Missile Delivery

India has several aircraft capable of delivering nuclear weapons against both Pakistan and China. India's most sophisticated aircraft are Anglo-French Jaguars, Soviet MiG-23s and MiG-27s, and French Mirage 2000s. On October 3, 1968, **Defense and Foreign Affairs Weekly** reported that since 1984 India has been perfecting a. nuclear aerial bomb and techniques for its delivery on MiG23 and

-27 aircraft.

* India has already successfully tested an intermediate-range ballistic missile with a range of 1500 miles; in February, Pakistan said it had test-fired two short-range missiles.

India has already successfully tested an intermediate-range ballistic missile with a range of 1500 miles; in February, Pakistan said it had test-fired two short-range missiles.

Although there is no public evidence that India has developed a nuclear warhead for missile delivery, India is developing ballistic missiles that are capable of carrying such payloads.

Choice

Pakistan and India can choose to aggravate or to prevent a weapons competition. Unless they constrain their nuclear weapons research and development programs, these programs could create institutional momentum within each country to build and test nuclear weapons. And if either country tests or deploys , the other is sure to follow, with dangerous consequences for the

security of South Asia and the rest of the world.

A test or deployment of nuclear weapons could also cripple current efforts to stop other developing countries such as Argentina and Brazil from going 'nuclear' and perhaps even undermine the viability of the Non-Proliferation Treaty. Several nations may find it politically difficult to be considered inferior to Pakistan in nuclear matters.

* A ban on nuclear tests and a

verifiable nalt in the production of unsafeguarded plutonium and highly enriched uranium would not prohibit either country from possessing nuclear weapons but would significantly limit the size and sophistication of their nuclear arsenals. India's recent decision to join other signatories of the Partial Test Ban Treaty in calling for a conference to expand the treaty is a hopeful first step in the direction of obtaining a universal test ban.

But the main goal in the region should remain verifiable commitments not to build nuclear weapons.

Courtsey: David Albright & Tom Zamora Bulletin of Atomic Scientists, June '09.

Tritium: Bad For Mice And Men

In December 1988, Canadian media reported what appeared to be the first identifiable health effects in citizens due to the release of radioactive material from the CANDU nuclear generating ■station at Pickering, Ontario. The news reports were based on a study performed by the Oshawa based citizens' group Durham Nuclear Awareness (DNA), which utilised published tritium release data an*d* mortality data. Like a number of health studies before it, health effects in citizens ' linked to industrial waste were first identified not by the medical community, industry or government health departments, but by concerned citizens.

At. Pickering it was the radioactive by-product tritium which was linked to increased newborn infant fatalities and certain types of birth defects. What is alarming is that it is routine and unavoidable emissions of "acceptable" levels of tritium which seems to have caused the health effects, and this suggests that, people living near CANDU plants throughout the world are at risk. All CANDU stations create and release enormous quantities of a highly toxic water form of tritium known as "tritiated water". Tritium is created when the large inventory of heavy water within the CANDU reactor captures neutrons. Tritiated water is chemically indistinguishable from water since tritium is an isotope of hydrogen. It is impossible to prevent the release of tritiated water without expensive and exotic isotope separation equipment. Except for the new Darlington nuclear station where such an experimental unit has been set up, all other CANDU stations are releasing tritium on a large scale.

Much of the scientific community is convinced that the release of tritium is not pollution and its build-up near power stations is not a public health threat. The owner of the plant, Ontario Hydro is able to control the timing of its tritium releases and handles tritium releases to air quite differently from tritium releases to water. Tritium released to air disperses widely and does so quickly. Ontario Hydro also has the capability to ensure that some of the tritium it releases to air is done at a time when the winds are blowing offshore.

Tritium in water does not disperse as quickly or as widely as tritium released to air. Tritium releases to water cause water contamination at nearby water supply plants for months afterwards according to Ontario Hydro's own document SSD-IR-80-7.

Tritiated water readily accumulates in people via drinking water, inhalation and other routes. Tritium is doubly

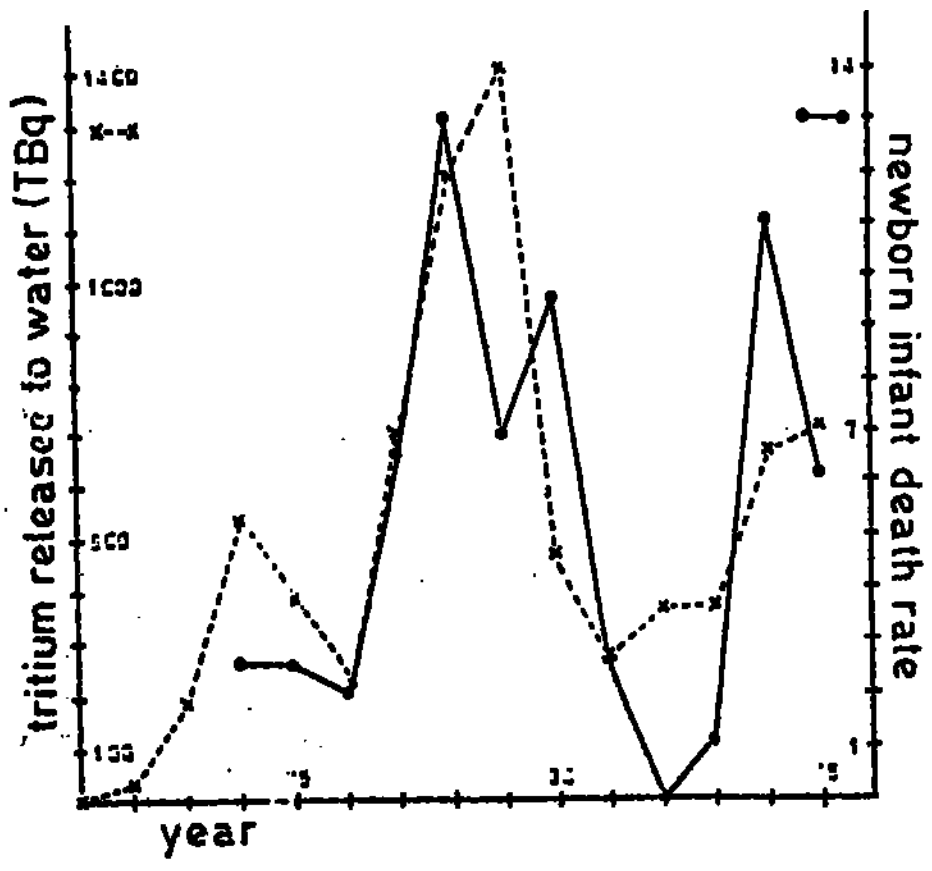
What is alarming is that it is routine and unavoidable emissions of "acceptable' levels of tritium which seems to have caused the health effects, and this suggests that people living near CANDU plants throughout the world are at risk.

toxic; firsely due to its beta radiation arid secondly due to the fact that tritium decay results in breaking of hydrogen bunds and this plays havoc with biochemical reactions. Humorous studies with mice and other laboratory, animals have shown unequivocal evidence of birth defeats and high infant mortality when tritium is administered in trace amounts to pregnant females or male parents besfore conception. For this reason, children of male nuclear plant workers could be especially at risk due to tritium.

Incorrect Tritium Figures?

The Atomic Energy of Canada Board (AECB) has indicated that the tritium figures it had published in its own report (INFO-0210 in 1986 and in a revised version again in 1987 were incorrect. The AECB now says that the tritium released to water figures for 1978 and 1979 it had published for Pickering power • station must be lowered by a factor of ten. (Even with this reduction tritium releases to water at Pickering in. 1977,1978 and 1979 were still very high.) The errors in. the AECB report were not detected apparently, until after' the DMA report was released.

Examination of the new: data reveals that the possible link between tritium emission end increases in infant deaths and fatal birth defects is now even more .bvious. It is tritium releases to Water and not air which now seem to be strongly linked to newborn infant fatalities. The match of these two curves between 1974 and 1985.' is: particularly striking.



More Study Needed

Citizens must ask whether the Ontario government and Ontario Hydro, who have invested $30 billion to date in nuclear projects in Ontario, are free from a conflict of interest in commenting on the threat to human health from tritium. This question is especially relevant as the experimental evidense associating, tritium with health effects in laboratory animals only surfaced -after Canada made its commitment to CANDU heavy water reactors. (It is not Camadian research which found these problems.) Another question that arises is to what extent has military secrecy concerning nuclear weapons and tritium (tritium is an essential component of thermonuclear weapons) leal to secrecy concerning health effects of tritium?

What. is clearly needed is acknowledgement that there is a potential health problem concerning tritium in our environment. Adequate health and epidemiological studies need to be carried out. We also need a comprehersive tritium health effects research programme.

David MeArthur

Editor's Note: Last year too we had an article "The Perils of Tritium" by Nigel Harle (Anumukti Vol.1 No.6 June '88) on the tritium threat. Tritium is of special relevance to us in India since the mainstay of the Indian atomic energy programme are the very same CANDU reactors, which release large quantities of tritium. Official fondness for them has nowadays become so great that they are refered to as "our own PHWR design".

Medvedev Vindicated

Recently there were newsreports headlined "Soviets Throw Light on a 32-Year-Old Nuclear Mishap". They reported a serious nuclear accident in September 1957 near the town of Kasli in. southern Urals. The cause of the accident was the explosion of a tank filled with radioactive waste. It created a radioactive trail 105 kms long and 9 kms wide and required the urgent evacuation of 10,000 people. Even now, about 20% of the contaminated area is still not fit for habitation. The accident was never reported since it occured at a defense factory intended for building atomic weapons.

These matter of fact reports hide a spellbinding tale. it is the story of one man's perseverance in the face of scepticism and ridicule by the entire-ties tern nuclear establishment. Zhores Medvedev is a Russian geneticist. While on a visit to England in 1973, his passport was; cancelled by the Soviet authorities. He has since lived in England. In 1976, the British popular-science journal, **New Scientist** invited him to write,- an article on the role of scientists in Soviet society. His article entitled "Two Decades of Dissidence" dealt mainly with the harm done,. science by the ideas of Lysenko. In ••""passing, it mentioned that, "one of the most important episodes which: brought a group of influential atomic physicists, together with the" persecuted geneticists was the nuclear disaster in the Urals." Medvedev at the time had no idea that Western experts as well as the media were uninformed about the. disaster. In the article Medvedev also stated the cause of the accident as an explosion in radioactive waste which had been stored underground for many years.

At the time there was a heated controversy in the British press. regarding nuclear waste. Medvedevs revelations sparked an immediate explosion. Nuclear experts immediately denied the story by claiming that it was "technically impossible". Most high handed was Sir John Hill, the the chairman of United Kingdom Atomic Energy-Authority. He called the article "rubbish" and dismissed it as "pure science fiction" and a "figment of the author's imagination". "This sort of waste has a very, very low activity and could not possibly give that sort of explosion, nuclear or thermal."

At this stage, CIA sources stepped in. Although an accident had in fact taken place, they claimed,"it involved a reactor that went out of control and had nothing to do with waste. Moreover, the reactor involved technology only distantly related to present day nuclear power plants and its relevance to the safety of nuclear power plants today is possibly minor."

A month later in December 1976, another Russian emigre scientist, Professor Tumerman, then living in Israel, confirmed Medvedev's account. In I960, while on road trip between Sverdlovsk and Cheliyabinsk he had seen road signs which warned drivers not to stop for the next 30 kms and drive at full speed. He also mentioned that by all accounts the accident had been caused by careless storage of radioactive waste

Despite this eyewitness account, nucleocrats remained sceptical. Sir John Hill reasserted, "even allowing the emote possibility of such an accident he probability that it could possibly ave had the kind of consequences .'escribed is even more improbable."

Medvedev's answer to this challenge - his credibility was a book - a feat of extraordinary research and analysis. Published in 1979, **Nuclear Disaster** *in* **the Urals** critically examines a large body of Russian published work in fields such as radiobiology, radioecology and genetics. Studies of intake of various radionuclides and their propagation 'Through different food chains routinely •mention the size and location of the area where the study is conducted as also the 'siming, the composition and the quantities of radionuclides introduced for the purposes of the study; a full .accounting of **the** radionuclides distri-bution and the amounts left after the experiment's conclusion. Medvedev found

that a very large number of Russian **papers** published during the sixties just om**itted** all such procedural details. Despite the omissions and in some oases, deliberate falsafications, he was able to glean the truth since the departures **from** normal experimental practice were so striking. For example, he showed that the contaminated area was not a small experimental plot as the papers seemed to imply, but an area at least hundreds, of square kms in extent by looking at the numbers of different kinds of birds fishes, mammals, trees, acquatic plants micro-organisms, etc. that had been studied by different researchers.

Nuclear Disaster in the Urals is a book which ought to be read by all - especially students of science not only for the facts it describes are- interesting and important in their own **right.,** but also as an illustration of the scientific method in practice. It **reads** like detective fiction. Clues are marshal led one after the other, till the conclusion seems unescapable. After its publication, no one, not even Sir John Hill could deny the fact of-the accident or that its cause had been the careless storage of radioactive waste.

After the book's publication groups in U.S.' tried to "find out the extent of CIA's knowledge regarding the disaster by U3e of the Freedom of Information Act. The CIA did have a very good knowledge of what had happened. They had not broadcast it however, because they did not want to jeopardise the emerging US civilian nuclear programme.

Why did the Russians decide to inform the world now after having kept quite for so long? They want to build a new nuclear plant in the region. This has raised a furious controversy. Officials claim that the plant would 'utilize' water still" contaminated from the previous disaster.

Lost at Sea

A new study released by Greenpeace, reveals that 50 nuclear weapons and 9 nuclear reactors were lost or dumped at sea during the post war period.

Naval Accidents of 1945 - 1988 by William Arkin and Joshua Handler documents over 2000 major accidents including the sinking of 75 vessels, five of which were nuclear powered, with the total loss of about 2,800 lives. Of the 1,276 officially recorded accidents covered in the report, 377 occured while the vessels were in port. A majority of out-of-port accidents (624) took place **in** the Atlantic, 318 in the Pacific, 110 in the Mediterranean and 34 in the Indian Ocean.

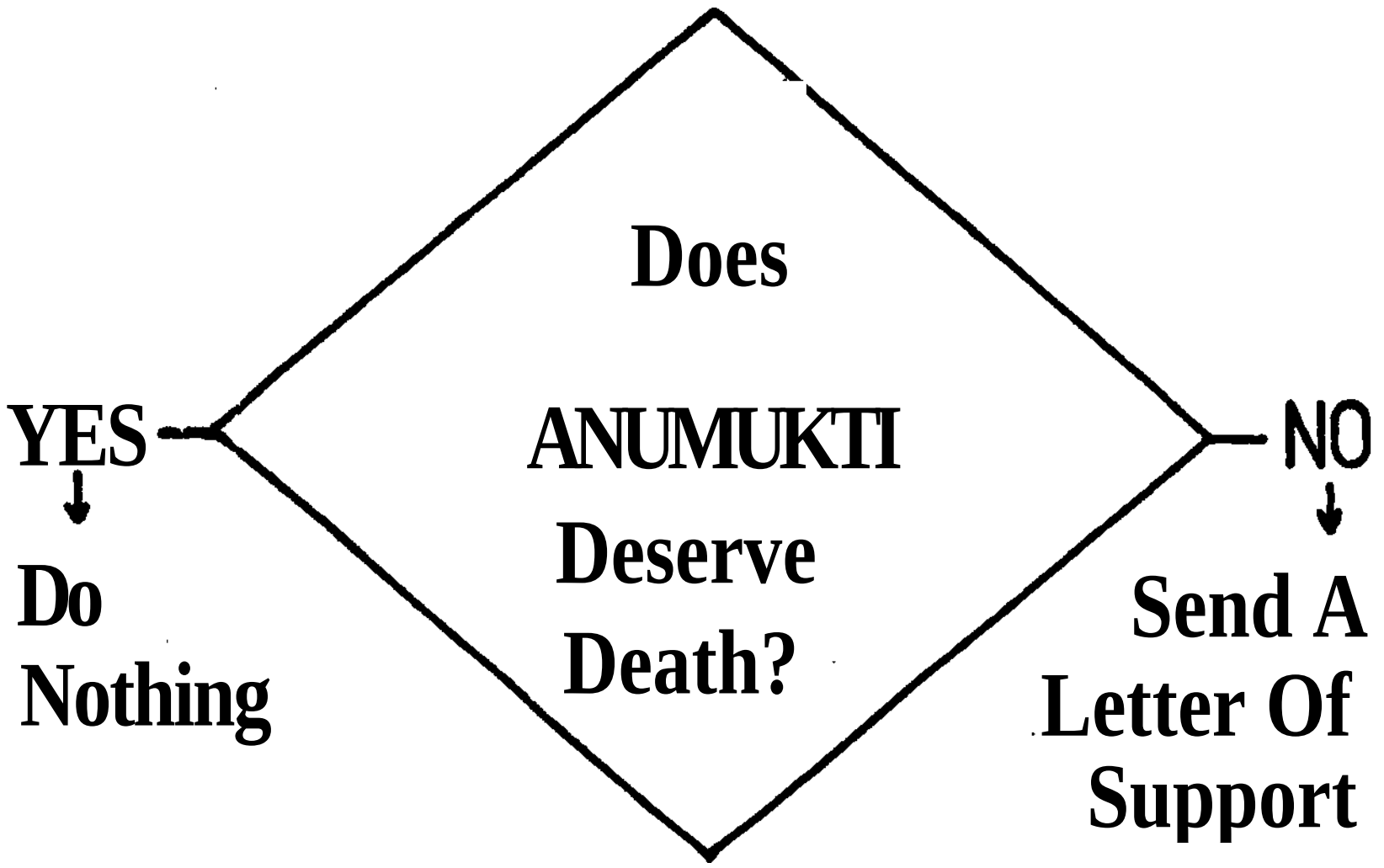
The most frequent causes of naval accidents were collisions, fires, **groundings** and explosions. Twenty seven submarines were lost at sea, of which **four** were USA, five Soviet and three British. Submarines belonging to Israel, Pakistan, Peru, Spain, Turkey and the FRG have also perished.

Launching the Greenpeace report at **a** press-conference, co-author Arkin said that although naval accidents would always be with us, the disasters .are far more dangerous when the vessels involved are nuclear powered. Arkin also mentioned that the authors had been unable to amass all the information on nuclear disasters due to the secrecy surrounding the subject in all countries. However, while preparing the report, Greenpeace for the first time had access to information about three major nuclear accidents on US naval ships, which till then had been suppressed. These were the loss of a hydrogen bomb from the aircraft carrier **Ticonderoga** off the Japanese coast in 1965, the fire aboard the **Belknap** in 1975 which broke out just twelve metres away from its nuclear weapon's **bay** and the leakage of radioactive water from the- reactor of the submarine **Guardfish** in 1973.

At present, there is growing concern about a spate of accidents on Soviet nuclear powered submarines in the last few months off the coast of Norway. Three serious accidents have taken place since April 6th, when a Mike-class submarine sank following a fire. 42 members of the crew died in that accident. Two nuclear reactors containing hundreds of kilogrammes of nuclear fuel and plutonium

from the sub's two nuclear torpedoes are **on** the ocean floor buffeted by the strong currents of the northern seas. **The** Soviets have promised to salvage the wreck. Unless they manage to do it in time, these dangerous toxins would be released to the marine environment sooner or later regardless of the condition of the submarines hull or the nuclear reactors today.

Source: Peace Courier June '89



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(Along with your **subscriptions)**

Anumukti a year ago had 556 subscibers. This year there are only 375 and just 18 have renewed for the next year starting from August. Obviously something is very wrong. Maybe j it is the fact that we have not been able to stick to the scheduled publication date. Or, maybe Anumukti is no longer interesting enough - become too technical, lacks human interest stories, has a poor get - up —

In any case, if you want Anumukti to survive, please let us know of the fact and suggest the kind of changes you would like to see. Without sustainance from you, in the form of interaction

PRIMED MATTER BOOK POST

Anumukti cannot live.

ANUMUKTI

A JOURNAL DEVOTED TO NON-NUCLEAR INDIA

Volume 2 number 6 **June 1989**

BARC AND BYTE

Sone representatives of voluntary organisations in Bombay had submitted a memorandun to Dr.M.R.Srinivasan, chairman, Atonic Energy Commission, on Hiroshima day last year. The memorandun disoussed issues arising out of environmental hazards of nuclear power plants; the large number of accidents that have already taken place in nuclear industry worldwide; the grave threat posed by radiation not only to the present but also to future generations, the people who had been displaced out of their ancestral lands and finally the eoonomic unviability of nuclear energy.

They requested the government:

1. "To stop setting up nuclear power stations till a national debate covering all aspects of the use of nuclear power is held."
2. "To scrap Section 18 of the Atonic Energy Act of 1982 so that infomation regarding nuclear power plants, instead of being kept a closely guaarded secret is given to the public, consistent with the inherent right to information which has to be guaranteed to every citizen in a democracy."
3. "Not to dub those who raise doubts about nuclear power as traitors or foreign agents."

The reply to this memorandun has been penned by Shri Vittal. He is presently Additional Secretary, Department of Atomio Energy (DAG). We are reproducing his reply in full, just to give an exanple of the kind of infornation one gets from DAE in this enlightened ara of openness. I an inserting comments within the body of the letter to provide readers with a contrast to this official view. I an thankful for a number of these comments to Shri Sanjay Havanur, a Bangalore activist who sent a detailed reply to Shri Vittal. It is for the readers to judge what to make of the much touted spirit of Glasnost in the DAB.

The Letter

DO Ho 17/43/88-PD September 8, 1988

This has reference to the memorandun presented on behalf of the

Bombay Sarvodaya Mandal. While I appreciate the interest you and other organisations have shown in our activities, I find that the memorandum contains a number of statements which are not factual or scientifically correct. Before I come to answering the points raised in your memorandum, I wish to present the following facts for your information:

Contrary to what is stated in the memorandum, Nuclear Power Plants (NPP) have been proved to be benign to the environment and do not cause any ecological imabalance. One of the important components of the environmental protection policy adopted by the DAE is that DAB operations shall not disturb the ecology of the nature in whatever manner detrimental to the ecosystem. A constant watch is being maintained through the environmental survey laboratories located at each site. These laboratories provide surveillance around the facility up to 30 kms. distance.

Comment

Almost a quarter million Soviets are living on land so contaminated by the Chernobyl accident that they must receive special food supplies to avoid overexposure to radiation, says Pravada. The Communist party daily printed maps showing contaminated areas of Byelorussia, the Ukraine and the Russian republics, in response to the readers' complaints that they did not have full information even three years after the accident. The area where the current level of radiation from the environment and food supplies would expose residents to a lifetime (reproductive - 30years) dose of more than 35 rems, comprises more than 10,000 square Kms. It includes 640 settlements with 230,000 people. (Tines of India 22.3.'89)

The International Council for Radiologioal Protection (ICRP) presently recommends an average dose for a member of the . general public of not more than 5 rems per 30 years. Even this has been criticised as being too high and the ICRP is in the process of reducing this limit further. For the Soviet Union to tolerate limits seven times higher just shows their helplessness in face of the severity of the contamination. Even with limits so relaxed, an area as large as 10,000 square Kilometres has to be essentially 'written off. To call a technology capable of producing such havoc as "benign to the environment" is benighted to say the very least.

In the Indian oontext there is only one agency which sets up nuclear establishments, decides how their pollution is to be measured, carries out the actual measurements, interprets the results, evaluates it own performance and finally pats itself on the back for its 'cleanliness'. In the absense of any public acoountability and independent critical evaluations, DAE's contenions are untenable.

Letter

It is also wrong to say that trees have been felled at various locations where NPP are oproposed to be set up. On the other hand DAB has been spending money to develop the green belt around our installations. In fact, today, clearances from the Department of Environment and Forestry are a must before starting any new project.

Comment

The objection to felling of trees is made with special reference to Kaiga Nuclear Power plant. Raiga is located in the midst of one of

the few remaining bits of tropical rain forests left in the country. Experience all over the world has taught us that the rainforest is a very fragile ecosystem and assaults on it in the form of human intervention are likely to destroy all of it. Harping on the green-belt 'created' by the DAE is to miss the woods for the trees.

Letter

It is not clear how you have concluded that 4,000 accidents have taken place in NPP's around the world including 300 in India. It is not also clear how these accidents have caused great danger to the present and future generations. I would like to point out that nuclear power has been in use for more than four decades and today there are 400 operating reactors in 26 countries producing 300,000 MWs of electricity which forms 16% of the world's total electrical installed capacity. Four major accidents have taken place since the beginning of nuclear power generation four decades ago. These are:

(i) Windscale accident in the UK in 1957
<ii) SL-1 accident in the U.S. in 1961
(iii) TMI-2 accident in. U.S. in 1979
(iv) Chernobyl-4 accident in U.S.S.R. in 1966

Comment

The word needs to be spread around our nuclear establishments that the incident at Three Mile Island should be treated as a 'major accident'. Dr.P.K.Iyengar, Director of the Bhabha Atomic Research Centre (BARC),speaking at the Bangalore Science Forum in September '88 had informed the public that TMI - 2 was not an accident at all, because, you see, "no one died there!" Dr.Raja Ramanna, former chairman of the Atomic Energy Commission (AEC) also needs to be informed that Chernobyl needs to treated as a 'major' nuclear accident. He is under the impression that Chernobyl was not a nuclear accident at all, but a "curious fire accident". (Bulletin of Sciences, a publication of Indian Institute of Science, Bangalore, August/September '88)

The figure of 4000 accidents in NPP's around the world is, in fact, . a very conservative estimate. Every year several thousand 'unusual occurences' are reported to the Nuclear Regulatory Commission (NRC) in the U.S.A. alone. In the four year period from 1980 to 1983, 744 events were considered particularly 'serious' by the NRC. Contrast this with the the system in India where unusual occurences, accidents number of forced SCRAMS, their reports, in short everything is kept safely away from public scrutiny.

Major nuclear accidents need not always be sharply defined single events.The military plant at Hanford, USA or our own thorium processing plan at Alwaye in Kerala have been continuously polluting the water sources for years. Radiation effects on living tissues are cumulative. The damage to public health and to the future generations will be done whether the radioactive pollutants are released into the environment in a single shot or distributed over decades.

Any list of major nuclear accidents which does not include the disaster near Ryshtym in the Soviet Urals in 1957 can not be called complete. Even official Soviet media have admitted to the occurence of this disaster which severly contaminated an area of 300 square miles and required the evacuation of 10,000 people. More than 30 years after the event lakes in the region are still contaminated.

Latter

In the Windscale and TMI-2 accidents there were no fatalities. In the other two accidents the fatalities were only those who were working in the plants. Ho neither of the public has ever died in a nuclear accident. I must also point out that with our present knowledge there has been no evidence of genetic abnormalities due to radiation seen in the human population. This conclusion is based on extensive studies on human populations including the Hiroshima and Magasaaki victims.

Comment

It is absolutely shooking to find statements like "No member of the public has died in a nuclear accident " still being made by responsible members of the atomic energy establishment. It is a display of the total lack of sensitivity towards the pain and suffering of the victims of nuclear industry. It is similar to tobacco industry apologists claiming that nobody has ever died of cigarette smoking since anybody who dies does so from heart attacks, respiratory failure, lung cancer etc. Deceitful statements like these are probably responsible for the very low credibiliy of nucleocrats.

It is universally accepted that radiation does cause genetio damage. The major evidence for this has come from animal studies especially on nice. The apparently reassuring absence of genetio damage in Hiroshima - Nagasaki studies needs to be viewed with caution. It is possible that an increase in severe mutations leading to miscarriage was masked by the high natural spontaneous miscarriage rate. Also, those mutations not leading to an early death of foetus would be likely to be recessive in charactor, that is abnormalities may not become apparent for several generations."

Radiation and Health: Dr.H.Dace

Letter

In the DAE, safety of NPPs is under constant review with a view to improving the safety status further with new developments. Following the TMI-2 accident a comprehensive review was conducted. after the Chernobyl accident we have made yet another review of the safety status of our plants.

It was concluded that our PHWR design has inherent safety features much better than other type of reactors.

Comment

To call the CANDU design as 'our PHWR design is something of a plagiarism. However, India is presently in the process of becomming the proving ground of various kinds of reactor designs from BWR (Tarapur) to CANDUs (Rawatbhata, Kalpakkam, Narora…) to Russian VVERs (Koodankulam) to French PWRs (?) Bach reactor design has different safety features and hence accidents in a partioular type don't contribute much to the understanding in a different type, except the crucial observation that catastrophio accidents result when the design faults are accentuated by operator failings. Thus statements like, "Our reactor designs have inherent safety features much better than other types" are irrelevent. None of the reactor types operating anywhere in the world or under construction presently are 'operator proof. Bach have different safety hasards. We have already disoussed the safety features andd the hasards of the CANDU design in the very

Letter

We know that exposure to ionising radiation does involve a small risk of cancer. There are many other chemicals, particles and agents in the environment which also cause cancers. It is only in the case of ionizing radiation that a systematic study has been carried out right from the beginning. This in depth study has not been undertaken in any other industry.(e.g. Chemical Industry) It is this knowledge which has helped us to achieve a defence-in-depth philosophy of safety in all nuclear installations. As I mentioned earlier genetic effects have not been seen in the human population; these are however, included in our risk assessment as a measure of abundant caution. I must point out that there is no human activity which is totally free from an element of risk. Because of Several beneficial effects of radiation, it is perhaps worthwhile for all of us to take a very small risk. It is this philosophy that has pervaded our safety practices.

Comment

Workers, military personnel and the general public have been given the impression that exposure to radiation involves a slight risk of cancer and that one's chances of escaping this are better than the chances of escaping an automobile accident. The probabilities of early occurence of heart disease, diabetes mellitus, arthritis, asthma or severe allergies - all resulting in a prolonged state of ill health - are never mentioned. Most people are unaware of the fact that ionising radiation can cause spontaneous abortions, still births, infant deaths, asthmas, severe allergies, depresed immune systems (with grater risks of bacterial and viral infections) leukeamia, solid tumours, birth defects or mental and physical retardation in children. (Ho Immediate Danger: Dr.R.Bertell)

It is perhaps worthwhile for all of us to take a very small risk." Perhaps Mr.Vittal, but who decides? You or the villager involuntarily living near a nuclear installation. The crux of the matter is that this 'small risk' is not shared equally by all.

Letter

It is incorrect to say that thousands of people have been uprooted at nuclear power station sites. Statisics show that the land needs for an NPP is only 0.3X to 0.4X of that needed for a hydel project. Even coal based power stations need more land than NPPs. The number of people displaced in an NPP project is also very small.

Comment

The statistics that an NPP takes only 0.3% to 0.4% of the land that is needed for a hydel project leaves me thoroughly confused. Official DAE documents claim an exclusion zone of 5 kms around an NPP for safety reasons. By elementary mensuration, this works out to be nearly 7,850 hectares. In case of Kaiga this is more than 1100X of the land submerged in the reservoir of the 240 MW Sharavati Tail Race hydel project also being undertaken in the North Canara district.

Letter

A detailed analysis of the thermal and nuclear power costs by an expert committee consisting of representatives of various departments

of the Government of India as well as representatives from the private sector has clearly shown that nuclear power is cheaper than thermal power taking into account the transport of ooal from the mines to the power station site as is being done at present. Further, in the nineties nuclear power will be competative with thermal power even at the pit heads, Incidently I must mention that Tarapur Atomic Power Station has not been decommisioned and still it is supplying 320 MW of power to Maharashtra and Gujarat. Today, Tarapur power is the cheapest non-hydel power.

Comment

Installation costs . of nuclear power plants have skyrocketed everywhere. As an example, even the official figures reveal that the Narora reactor has cost around a hundred times more than the Tarapur reactors. Similarly, operating costs too have'gone through the roof. This is due to the fact that many new safety features have had to be added-on following nuclear disasters elsewhere. Thus it is not clear to me that how this 'high' powered committee came to the conclusion that "During the nineties nuclear power will be competetive with coal even at the pit heads." Is it a reflection on the incompetence of the coal based thermal power people? Or, is it that in the interest of 'cheap' nuclear power safety considerations have been given the back seat? If in fact, operating costs are becoming less in India while they are shooting up in the rest of the world, this fact ought to be publicised far more. We can export this 'knowhow' to other countries specially to the so-called industrially advanoed nations who are not so 'smart'.

We are aware of the costing exercise conducted by the expert oommittee which concluded that nuclear power is only marginally cheaper than coal far away from the pit heads. We are also aware of the following:

(i) The cost of decommissioning NPPs and of waste storage is not accounted for. Decommissioning costs are presently estimated to be at least 50% to 100% of the construction costs, but in our budget they are shown as being less than 1%.

(ii) The Comptroller and Auditor General's office has pointed out that the heavy water costs have been manipulated to an extent that less than 30% of the true cost is reflected in the accounting,

(iii) During the National Workshop on Nuclear Energy, Dr.A.K.N.Reddy had shown the several juggleries carried out with interest rates so that lower costs could be presented.

Letter

It is not true that the U . S . has either stopped commisioning of new nuclear power plants, or phasing them out. In the Unied States as of December 1987, there were 106 reactors producing 93,000 MW and four units under construcion with a 'capacity of 2,500 MWs. In the USSR, 56 reactors are operating with 33,600 MW and 28 reactors are under construction with a capacity of 28,000 MW. In fact, after Chernobyl, USSR has developed an improved version of the RBMK reactor. Only Austria has decided not to operate a nuclear power plant after completing construction. Given the small population and adequate resources it could afford to take such a step. It could also obtain gas or elecricity from neighbouring countries.

Consent

The article, "Beneath the Veneer of Progress - a Sick Industry** in the last issue (Vol2.No.2,3) of Anumukti documents in detail the sorry state of nuclear industry in other countries. It is in fact this terminal illness of the nuclear industry in its home markets which has lead to the spate of irresistable offers to third world countries such as India. The illustrative though not exhaustive list would have become more illuminating if it had included mention of countries such as Yugoslavia, where a law has been passed banning any further nuclear construction or Italy where 80% of the people have rejected nuclear power in a referendum. The list could have also gained from a mention of countries such as Sweden, Denmark, Finland, Greece and Philippines who have all been rethinking their commitment to nuclear programmes.

Letter

Taking into account the above facts which are not exhaustive but only illustrative, it is clear that there are many inaccuracies and mistaken notions in your memorandum based on wrong information and that this wrong information is apparently responsible for your three demands. The position regarding these demands is as follows:

1.Stop setting Up Atomic. Power Stations at. least till a National Debate. is. held;.

Starting with the commisioning of the first atomic power station in 1969 at Tarapur, nuclear power plants have been operating for 20 years. Our safety records in respect of safety of operating personnel the public and the environment have been excellent. All aspects of atomic energy including safety and economic aspects have been described in open documents. Being a Government organisation, the DAB is subject to review by the parliament commitees as well as Members of Parliament. In every parliamentary session, a large number • of questions covering all aspects of atomic energy are being answered over the years. In my view, this itself forms a major debate through the democratic channel, and therefore, I do not see any reason to stop setting up power stations and thereby denying much needed electrical power for the development projects in the industrial as well as the agricultural sector.

Comment

What are isssued in each session of parliament are self-congratulatory platitudes by the ABC. Most of our MPs are ignorant of the true hazards of nuclear power and the lack of environmental ethics involved in its generation. To call what transpires in the parliament as a "major debate" is a travesty. And, as per the 1962 Atomic Energy Act, the DAB is not even answerable to the parliament.

The only true debate on the NPPs was the one sponsored by the opposition ruled government of Karnataka. A debate where the nuclear establishment was thoroughly exposed, out a sorry figure, and where you, Mr.Vittal made the remarkable statement that "the era of secrecy has ended in the ABC." If your letter is any indication of the future the era of disinformation is just beginning.

Letter

2. To *Scrap* Section l8 of *the* Atomic Energy Act:

There is no need to scrap Sec.18 of the Atomic Energy Act as it is required in the interest of national security. As mentioned above all

relavent information is being provided to the public through the answers to the questions raised in parliament.

Comment

What Section 18 of the Atomic Energy Act protects is not national security but the fact that nuclear power has been as colossal a failure in India as elsewhere. What is denied by this act is public accountability

Letter

3. No dubbing of those, raising doubts about nuclear:
To my knowledge no such dubbing has ever been done.

I hope that the above facts, clarifications and answers would be of some use to you to get a clear picture and appreciate the important contributions of nuclear power to meet the ever increasing demand of electricity in the country.

Comment

Antinuclear activists have been dubbed unpatriotic by none other than Dr.Raja Ramanna, the former chairman of the ABC. The harassment of nuclear critics has been going on for a very long time. The case of Dr.Dhirendra Sharma is an illustrative example.

I personally welcome Mr.Vittal's statement that no dubbing has ever been done, as an expression not of past practice but of future intention. It is the first prerequisite which all of us must adhere to in order to raise the level of the nuclear debate.

Anunukti needs your support and subscriptions

CALCUTTA CONVENTION ON NUCLEAR POWER

A convention on 'Nuclear Power and its Acceptability' was held in Calcutta on 30th of April,'89. The day long meet was attended by about 250 people. Amongst the audience were many distinguished academics, civil servants, artists and theatre personalities, engineers, doctors and social activists. The atomic energy establishment sent three representatives. They were Dr.A.K.De, the chairman of the Atomic Energy Regulatory Board; Dr.Bikash Sinha, the chairman of the Variable Energy Cyclotron project and Dr.L.Krishnan from the reactor safety unit at Kalpakkam. As has by now become commonplace these worthies were comprehensivly outdebated by the antinuclear spokespersons who included Dr.Dhirendra Sharma of JNU, Dr.S.Jana from the Institute of Public Health, Dr.S.Basu of Jadhavpur University and Dr.S.Gadekar of Anumukti. Many issues, particularly those of social justice and public accountability of nuclear power were well articulated in the inaugeral session by Dr.Sujit Das, Shri Amlan Dutta and Shri Ashok Mitra. During the afternoon session, many common problems enCountered by activists were discussed. The convention, the first of its kind in the eastern regions of the country, was the result of untiring efforts by many volunteers. Particular mention must be made of Shri Pradeep Dutta and Dr.Sujit Das.

SHADOWS OVER SRILANKA

As little as a year ago, Sri Lankan intellectuals used to shrug their shoulders when the nuclear issue was raised - "of what concern is it to us? Kalpakkam is hundreds of miles away." But after the signing of the agreement to import two Russian built reactors by India, the situation has begun to change here as well. The prospect of having two large nuclear reactors at Koodankulam just off Sri Lanka's coast is disturbing.

The Shadow Region

On February 1st, 1989, inspite of the ongoing civll war and the heotic election campaigns, some people got alert when the large daily The Island published ,an article about Sri Lanka's radiating future and commented on it editorially. The paper was alarmed especially by a statement that "Koodankulam lies in the shadow region of Sri Lanka", made by the project director V.S.G.Rao in a seminar at Madras University and carried by The Hindu on January 29th 1989. Rao also said that cyolones would not affect the plant and that seismic studies show that it's rooky foundations are safe.

The Sri Lankans are mainly concerned about the safety of the reactors. Since Indian nuclear technologists have had no previous experience of operating plant of this type and of such large size, they tend to disbelieve their assurances regarding safety.

But they.. are also conoerned about other issues. Besides environmental concerns' and questions about waste disposal, they are especially suspicious of India's claim that the nuclear programme serves an entirely peaceful purpose: they see it in the context of the development of India's 'Agni' missiles of intermediate range. Sadly but truly, public opinion in Sri Lanka does not see India as a peaoe loving neighbour.

IAEA Inspection Demanded

The Sri .Lankan demand to ask for an IAEA (International Atomic Energy Agency) inspection of the plants , though understandable in this perspective, is nevertheless, strange. IAEA's own involvement in the promotion of nuclear industry is well known and should not be overlooked.

Sri Lanka joined the IAEA in the 1950's and on its recommendation formed its own national Atomic Energy Authority (AEA) in 1969. Since then, IAEA has helped Sri Lanka in the establishment of several "beneficial' products of nuclear industry like the nuclear imaging centre at the Colombo hospital. Besides medical research, it has also helped in spreading nuclear techniques in the fields of archeology, food preservation and in various branches of industry.

AEA chairman Dr.Granville Dharmawardhane sees IAEA's role as a much needed corrective in international nuclear affairs. Nuclear energy, according to his , may reduce or widen the gap between rioh and poor countries. As industrialised countries tend not to share

their knowledge in this field with other countries in order to protect their own economic interests, and as the developing countries absorb new technologies only slowly, the IAEA cones into help. It was only due to IAEA assistance, he says for example, that the Radio Isotope Centre at Colombo University was established.

The Man **Who Needs Watching**

But Dr.Dharmawardhane's aims go far beyond the use of nuclear techniques in industrial investigations or medical research. That is only the first step, to be followed by the creation of a nuclear research facility and reaching its ultimate objective in the use of nuclear power reactors. The fuel for fulfilling his dreams, he hopes to obtain from seawater. (Nuclear News.Bulletin of AEA, July '81; Daily News 26.3.'85 and 24.12.'88).

Very euphoric portraits of Dr.Dharmawarahane already started appearing in Sri Lankan papers as early as 1980. In one he was described as " the man who is to be watched, for nuclear applications are dawning on us with a big bang! "(Daily News 26.11. 80)

Plans shelved

While nuclear power generation was not considered feasible in Sri Lanka in the early 1960s, the issue cropped up again in 1980. That year President J.R.Jayewardene appointed a committee of experts to report to his regarding the feasibility of nuclear power generation in the country. The recommendations of these scientists not to build a nuclear power plant this century and public protests influenced him to shelve the idea.

Dr. Dharmawardhane is however, not sitting idle. His own group of experts recommended in an 82-page report the construction of a nuclear power reactor in Sri Lanka by the early 1990s.(Sunl0.1.'81) While the island republic was struggling with other problems, interested circles have never remained totally silent about their plans to press for a nuclear future.

Among them is Hr.Aelred Fernando, Director, Energy Planning in **the** Ministry of Power and Energy, a man who had part of his education with the help of the IAEA. Mr.Fernando hopes to create a core group of scientists who by the year 1994 could undertake a new feasibility study for the establishment of a nuclear power plant going critical by the year 2004 AD (Daily. News.12.9.'86)

Creating a Lobby

At Moratuwa University near Colombo, a large number of electrical, electronics and mechanical engineering students have already specialised in nuclear engineering. Between 1983 and 1985, the output was estimated to be about 100 trainees.(Sun. 22.2.'85) Although these people are supposed to find employment in existing institutions where nuclear techniques are alredy in use, "one cannot escape the feeling that this could well be the lobby that would clamour for nuclear power," as Mallika Wanigasundara remarks.(Daily News 12.9.'86)

The Indian army sponsored Provincial Council government in **the** north and east of the island in the beginning of this year also decided to investigate into the possibilities of building a nuclear power plant in this area of its influence. The government is under pressure from environmentalists protesting against the building of a thermal power plant near Trincomalee. A nuclear plant would also **make**

the north and east more independent of the hydroelectrio power now produced mainly in the central province.

On the same day that Sri Lanka discovered the "Nuclear Danger from Tamilnadu"(The Island 1.2.'89), a whole page advertisemnt appeared in the same paper, describing the new Siemens 'gamma camera' installed at the Nuclear Imaging Unit of the Colombo General Hospital. Whether ultimately Sri Lanka does or does not 'go' nuclear, it is already a ready market for the 'beneficial 'byproducts of the nuclear industry.

"Proteot Waters, Protect Life March

On May 1st, the Kanyakumari police sprayed bullets on the demonstration organised by the National Fish Workers Union to draw national attention on the question of water, which is becomming scarcer and dirtier, thanks to the wrong development policies.,, The march, which began simultaneously from Calcutta and Bombay on 1st April converged at Kanyakumari for a colourful Hay Day demonstration and an evening public meeting which was to be addressed by Justice VR Krishna Iyer, Tom Kochery and Mathias Saldhana.

This is the first instance of a trade union giving a call to focus national attention on an environmental issue which affects the whole population. The marchers identified and campaigned . against 19 monsters which include the Baliapal missile launch site and atomic power plants at Kaiga and Koodankulam.

Host of the over 10,000 participants (7,000 women) came from the coastal villages of Kanyakumari.Tinneveli and Tuticorin of Tamilnadu. The participants from Tamilnadu and Kerala expressed their determination not to allow construction of nuclear reactors at Koodankulam in Tinneveli district of Tamilnadu.

Immediately after the firing the police disconected the public address system thereby preventing the organisers from addressing the people. The public meeting to be held was declared unlawful. Several environmental groups have asked for a judicial probe in to the incident.

Acoording to the official version, an internal squabble amongst the marchers led to police intervention followed by stone throwing by the marchers. Independent investigations reveal that there was an organised attempt to disrupt the march.

Public participation in the demonstration was by all accounts beyond even the wildest dreams of the organisers. There were more than double the number of people who had gathered in Kanyakumari to hear the Prime Minister during the recent election tour.

LAST RITBS FOR ATOMIC ENERGY?

Members of the Citizens for Alternatives to Nuclear Energy and other activists held a protest programme in Bangalore on 26th April. Dr.B.C.Ramachandra Sharma, Dr. Sumatindra Nadig and Dr.D.R.Nagaraj addressed a public meeting held on the occasion.

Later the activists took out a procession to the Nuclear Power Corporation office and submitted a memorandum demanding stoppage of work at Kaiga. The NPC officials conceded the activists' demand for closing down the office in memory of all the victims of radiation and downed shutters for the day.

Interview with John Goffman

Dr John Goffman is the Professor Emeritus of Biophysics and Medical Physios at the University of California, Berkeley; He was formerly associate director of the Lawrence Livermore National Laboratory; as a graduate student he was the co-discoverer of uranium-233;He has authored several books including Radiation and Human Health(1981), X-Rays: Health Effects of Common Bxams(1985) and Radiationlnduced Cancers from Low-Dome Bxposure(1989)

Several reporters have been asking me about a revival of nuclear power because of worries about the greenhouse effect. Here are- my answers to some of the most common questions.

* "Given the Greenhouse effect, would you still oppose nuclear power if an inherently safe reactor could be designed as nuclear protagonists claim they can do?

YES, I would still oppose nuclear power. ,

Havn't they been claiming that the present designs are safe too? But the truth was stated very well by Dr.Nunzio Palladino, who was the dean of the Pennsylvania Stats College of Engineering before he became the chairman of the U.S. Nuclear Regulatory Commission (NRC) In a sworn testimony on August 21, 1970 before the Pennsylvania State Senate, Palladino said: "Though we can generally tell when we have a very unsafe reactor, it is always hard to know how safe you are with one you believe to be safe."

A recent example in a long series of nuclear engineering 'surprises' occured at the La Salle plant near Chicago. The New York Times reported July 10, 1988: "A huge oscillation in the speed of a nuclear reaction at the La Salle plant has prompted an inquiry into whether a whole class of nuclear plants are vulnerable to a dangerous condition that engineers had predicted was impossible to occur ..."

The problem is not Just surprises. The nuclear record reeks from cover-ups of RECOGNIZED safety problems. And beneath it all, you have got engineers thinking their designs incorporate an "acceptable" margin of safety based partly on a severe underestimates of the cancer hazard if their designs fail. And on top of that, you have got reactors which grow more radioactive, less approachable by humans and more like brittle glass-jars as they operate. The ultimate hypocrisy of safety claims is revealed when representatives of the nuclear community try to con the public into believing that containment structures will prevent catastrophic accidents, when they clearly do not believe it themselves. They keep proving that radiation disasters can happen by pressing for liability limits on radiation disasters which they claim are IMPOSSIBLE!

Given the record of broken promises, 'surprises',cover-ups deceptions and hypocrisy, I think a person would have to be very very naive to rely on any current claims about a breakthrough in safety.

* " So you don't believe that there is an inherently safe reactor coming along?"

Recall the warning from Dr.Palladino. Host of all, realize that radiation disasters can happen in the absence of spectacular accidents. Let us consider some very simple arithmetic:

Thr radioactive cesium-137 produced each year by a 1000 MW nuclear power plant amounts to nearly 4 million Curies. Since its radioactive half-life is 30.2 years, very little of it decays during a year.

According to Soviet estimates, the Chernobyl reac\tor contained a two year cesium inventory of about 8 million Curies. After the accident about 1 million Curies were deposited within the Soviet Union. Approximately another million Curies were deposited outside the Soviet Union in Europe. Combined that amounts to about 25% of its two year inventory, which is the same as 50% of the cesium-137 produced by one year of operation.

Now, let us consider 100 large nuclear plants that are presently operating in the U.S.A. for a life span of 25 years each. Call 'A' the yearly oesium-137 production by one plant.

Then 100A = Yearly'production by 100 plants

Lifetime production = 25Years x 100A/year = 2500A

99.9% containment = loss of 1 per thousand

With 99.9% perfect containment, loss = 2.5A

Chernobyl's loss = 0.5A and hence ratio = 2.5A/0.5A = 5

This ratio, 5, has an enormous meaning. It means that even achieving 99.9% PERFECT CONTAINMENT of the cesium-137 produced by 100 presently operating plants during their 25 years of operation, through all steps of the cesium's handling upto the final burial, would still result in a release equivalent to 5 Chernobyl accidents. This assault on human health would occur without blowing the roof off any single plant. Worldwide there are about 400 plants underway, so that the same scenario (99.9% success in containing cesium) would mean cesium loss equivalent to 20 Chernobyl accidents per 25 years of operation.

Radio-cesium is far from being their only poison. Nuclear power plants produce the same variety of poisons as do atomic bombs. During each year of operation, each plant produces radioactive poisons equivalent to about 1,000 Hiroshima A-bombs, PERFECT containaent is essential.

In addition to the fission products there is radon. Extra radon poison is necessarily released during the process of mining uranium. Radon comes from the deoay of the thorium-230 left in the 'tailings'. In ay 1981 book I have shown that fuelling 1,000 plants would release enough radon to cause 450,000 fatal lung cancers for each year that those 1,000 plants operate. These deaths would not be imposed on ourselves. They would occur over many thousands of years among our descendents. Nice legacy.

* "So you are saying that the poisons are going to get out, even if we prevent spectacular accidents?"

You bet I am. Not Just radon. Fission products get out in the endless series of small leaks, burps, and spills which we hear about. Nuclear pollution requires nothing spectacular. Just the commonplace: leaky pipes, mistakenly open valves, faulty O-rings, cracked coment, stuck needles in a dial, human carelessness and even people literally asleep at the switch.

Fission products are also getting out by INTENTION: the so called "permissible" releases. Today even scientists at the very heart of the radiation community are finally warning that ionising radiation is about 11 times more carcinogenic than they previously admitted. (My independent analysis shows the hazard is worse than that.) Nonetheless, the Nuclear Regulatory Commission (NRC) proposes to designate certain low level waste "below regulatory concern", and to

let it go straight into local dumps. And accumulate there. NRC admits some of it might get into people via air and water, but claims the cancer hazard won't exceed "permissible" rates like 1 case per million people.Such proposals, like all other "permissible" releases to the environment, are based on denying the true toxicity, and using dubious data on transport in the environment and promoting the doctrine that it is morally "acceptable" to cut our own costs by contaminating the planet for future generations.

With that kind of moral code, I see no barrier against steps towards the following scenario: You have a nuclear facility with vents and pipes for the "permissible releases" to the environment. Each exit is monitored by a mater, whose threshold for detection can be set at various levels. If you design enough vents and set the detection threshold high enough, *you* could release up to 100% of your radioactive poisons and still produce a monitoring record which says that you released ZERO.

If the nuclear communiy claims that releases from nuclear - power plants cause an average dose below a millirem per year, or that radioactive poisons will be contained to one part per million or whatever, deep skepticism is the appropriate response. It's been earned.

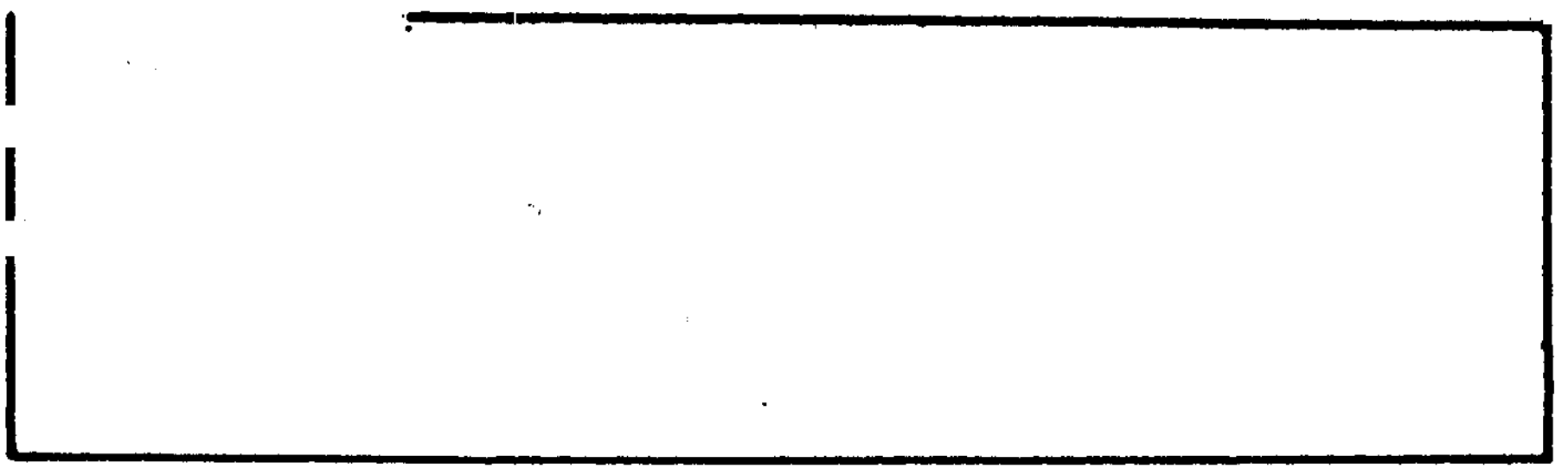
* "So your opposition to nuclear power is based on a deep distrust of the industry?"

The very nature of nuclear power makes it unacceptable, even under a better moral code. I oppose it because it creates astronomical quantities of radioactive poisons which will remain toxic for hundreds and sometimes thousands of years. These poisons cannot be reduced, they cannot be detoxified, they cannot be recycled and they are non-biodegradable. They decay,at their own immutable rates. Even when they are contained, they cannot be disposed off at all - they can only be moved from one location to another,

Ionizingg radiation which is the hazard Iron these poisons, is definitely one cause of heritable genetic mutations and chromosome injuries. When exposures occur after conception, in utero, one of the proven hazards, is mental retardation.

Furthermore, ionizing radiation is not just one entry on a long list of SUSPECTED causes of human cancer - it is one of the few PROVEN causes.In fact it may be the only one where proof now exists that there is No harmless threshold dose or dose-rate. Every bit of exposure adds to the rate of human misery for sure.

So, I have no choice but to regard nuclear power as a loony, demented choice, and a real crime against all our descendents. I have



said enough.

Weloome CANE HEWS

A six page antinuclear newsletter from Citizens for Alternatives to Nuclear Energy (CANE) has started publication from Bangalore. The purpose of the newsletter is to "place on record with appreciation and gratitude, the efforts of thousands of people as well as to inform well wishers all over the country of what is actually happening at Kaiga." The appearance of the newsletter is an indication of the strength of the movement against nuclear power in Karnataka. Anumukti sincerely hopes that CANE NEWS will grow from strength to strength and be the forerunner of many such publications from differrent parts of the country.

Address: CANE, 809, 17 Main, 5th Block, Rajaji Nagar, Bangalore

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Address: CANE, 809, 17 Main, 5th Block, Rajaji Nagar, Bangalore 560010

LETTER BOX

Chernobyl day was observed in North Canara district as a day of fasting and protest against the installation of the nuclear power plant at Kaiga. In response to the call liven by the Uttara Kannada Parisara Samrakshana Samiti, Sri Visweswara Thirtha Swamigalu of the Pejawar Butt, Udipi undertook a fast at the gates of the Kaiga project. 500 satyagrahees sarched from different talukas of the district to the reactor site. The authorities had suspended the plying of the state road transport buses from Karwar to Kaiga for two days fearing that they would be used by the protestors. Despite these difficulties the protestors did enter the Kaiga site. It took nearly three hours for the police to round all of thee up.They were taken to Karwar late in the evening where the police refused to feed thee stating that they Mere free to go where they pleased. The satyagrahees spent the night in the open near the police headquarters in Karwar and the next day they took out a silent procession to the deputy commisioner's office. Here, a delegation net hie and presented hie with a memorandum for the Prime Minister. They then dispersed after deciding on the next step in their caspaign.

H.S.Doreswamy
6andhi Bhavan, Kumara Park East,
Bangalore-1

The Narora Atomic Power Plant went critical on the 12th of March, 1989.The process of attaining criticality was kept a secret till the last moment by the DAE. This highhandedness is a demonstration of their utter contcept towards human beings.

A visit to Narora revealed the following shocking facts to us:

1. The mandatory 1.6 Us safety fence has not yet been constructed.
2.People are still living within this 1.6 Kes buffer zone and hence are being subjected to radiation without their knowledge or consent.
3. There have been ruaours of workers having been contaminated during test run's.
4. People are being forcibly evicted by the police though tote of thee have not yet received any compensation.
5.The rehabilitation programme is non-existent. Evicted farmers do not have any work after the current harvest. Horse still they are being forced to live in slums near Narora.

A.Public safety measures leave much to be desired. IAEA regulations state that the public residing it the vicinity of plants must be informed about the hazards posed by these plants; fire, medical and other emergency services tost be geared to handle radiation related eventualities. None of these requirements have been met at Narora, or any of its surroundings - an area of high population density. There have been serious allegations regarding use of substandard materials in the construction of the plant. Brave risks are being taken with the lives of millions by reckless technocrats.

We are an informal antinuclear group operating frot Delhi trying to raise awareness on this issue, be strongly urge you to take up this task of exposing this fraud now being touted as a 'great achievement.

Rajeev Singh and Ratna Mathur
NONE(Network to Dust Nuclear Energy)
Flat AD-118-B
Shalimar Bagh, Delhi 110052

It was nice to see Anumukti back in circulation after i long, long time. After the National workshop on Nuclear Energy last December, we have brought out a detailed pamphlet in Kannada on what happened it the debate. Me also plan to bring out a CANE newsletter sainly about the anti Kaiga activities in Karnataka.

Sanjay Havanur
61 Central Excise Layout,
Vijaynagar, Bangalore -40.

The issue of nuclear power is getting tore and tort important. I think that is part of our achievement. It is true that we are very far from our goal - but if people like you keep on continuing their activities - it will produce results in the future.

Sometimes I feel that sharing of feelings and warmth between activists is more important than here collection and dissemination of information. Ofcourse I don't sean to say that 'decoding' of information is of little or no importance. But meeting people belonging to the same Mavelengh gives a greater impact which helps the activist.

The latest issue of Anumukti was it a way a very good compilation of articles with supportive information. But have you any plans to improve the getup of the journal with pictures and cartoons? It involves money and manpower - I know. But can't we try to collect that resource?

Dr.Smarajit Jana
Ultadanga VIII-M, Housing Society
Flat N0.C3/1
Calcutta 700067

I wish to refer to the article 'Disasterous Drill' in the last issue of Anumukti. I believe that even if DAE falls far short of the accepted standards of performance it the drill, it is nevertheless a desirable drill particularly as we have already acquired a hazardous indesirable set up including nuclear plants and several other industries of equally great destructive capacity. Even

people's attention for disaster preparedness so that in the mot of on unfortunate incident taking place, tot danger to lift and property can be ainimised. The exercise also underlines tot great part played by resour in all such disaster situations.

M.K.Jain
Joint Assistance Centre
N-65, South Extension-1
New Delhi ll0049

Last year by uncle became the sarpanch of the village panchayat of Rawatbhata (Kota).Me tells me that the Rajasthan Atomic Power Project authorities discricinate against the local popultion. So mach so, that even basic amenities such as water and medical facilities *are* denied to thea. Even after so many years the project has tot generated any significant employment for the local population. Secondly, they have still 00 knowledge of any safety seasures they sight be reqquired to take in case of a catastrophe.

liked the new issue of Anumukti. Do you have a copy of the Ramarao Committee report? Does it contain anything of significance?

Sunil
Bansalkheda (Saheli)
P.O. Kesala via I tarsi
Moshangabad (M.P.) 461111

Editor's Reply: Although Dr.. M.R.Srinivasan had promised to provide this and other reports at the bangalore workshop last year, and had specifically appointed Dr.M.V.Ramaniah for the purpose, a reqest to Dr.Ramaniah only elicited the response that "one or two document repositories are being planted and one would have to wait till these repositories begin functioning in order to get the reports.*

Rancho Seco: Shut Down by Citizens

The Rancho Seco reactor in California, U.S.A., became the first reactor in the United States to be shot down by the disapproval of voters. In a referendua on June 6th, voters of the Sacramento Municipal Utility district rejected continuation of further operations at the plant, by a vote of 53.42.

Tot Rancho Seco has had a troubled history from its beginning in 1974. Its lifetime capacity is only about 407 and it suffered two 'near misses,' one in 1978 and another in 1985.

The Rancho Seco case takes clear the declining treed In nuclear economics. Although the plant was relatively cheap to build by current standards - it cost only 1375 million - rising operating and maintaianance costs made its electricity uncompetitive.

Sources The Nuclear Monitor June 12, 1989

All APOLOGY -TBT AGAIN!

Anunukti has fallen so far behind schedule that it is a scandal. Mo apology can suffice. The only redemption can be immediate and vigorous efforts to bring Anumukti back on schedule. This we are trying to do. We have numbered this issue Vol.2 No.6 to bring it in line with the date of publication. We hope to despatch Vol.2 No.4 which will mainly focus on energy conservation by the 10th of July and Vol.2 No.5 which will celebrate the bicentenary of the French revolution by highlighting French nuclear imperialism in the Pacific by the end of July. We shall resume regular publication from mid August with Vol.3 No.l.

We wish to thank Shri l.J.Desai for use of his computer which has allowed us to compose this issue. Special thanks are due to Ms Falguni Desai for her help.

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